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EDITED BY THURSTON SCOTT WELTON, M.D.

January 1943

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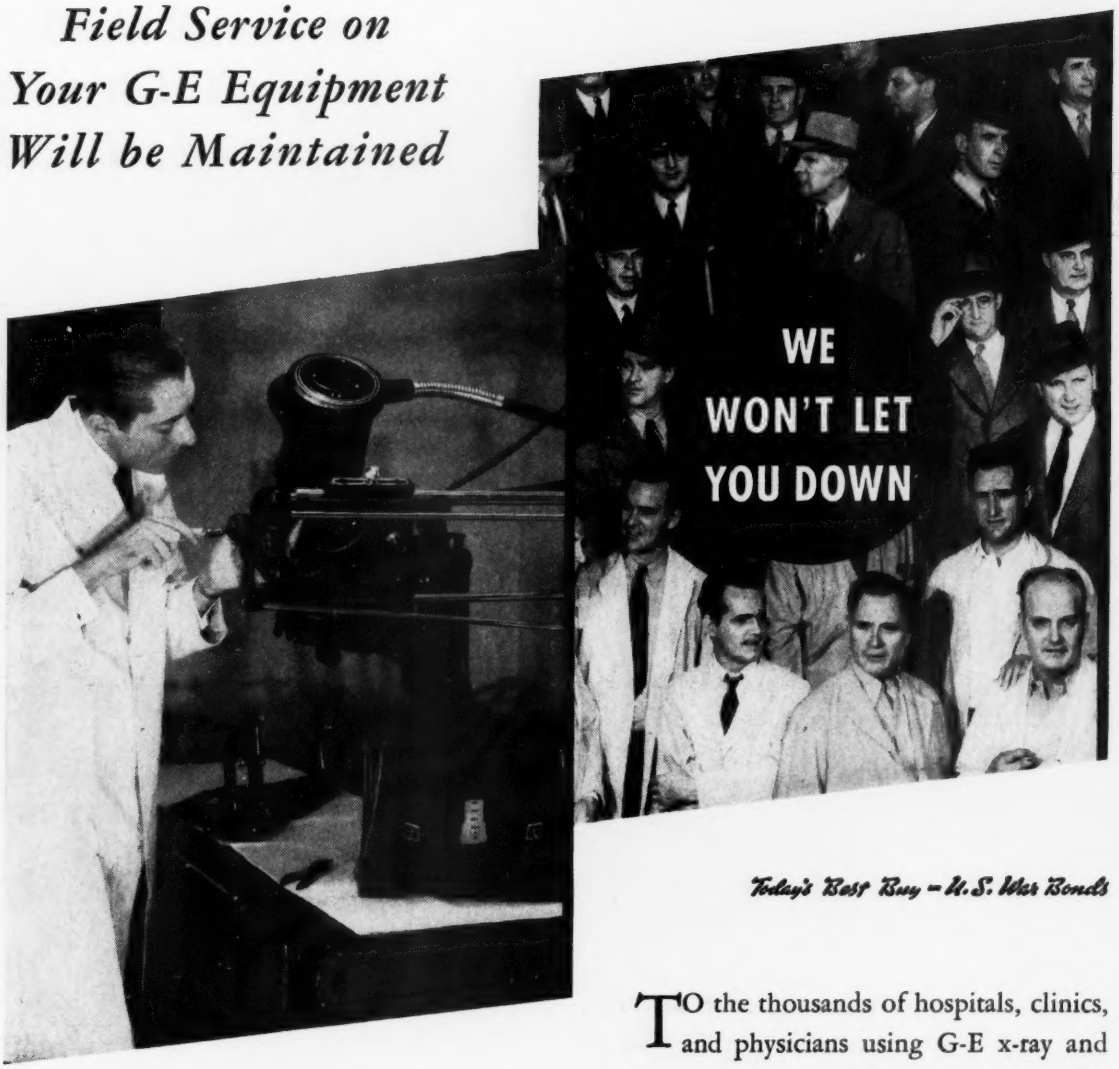

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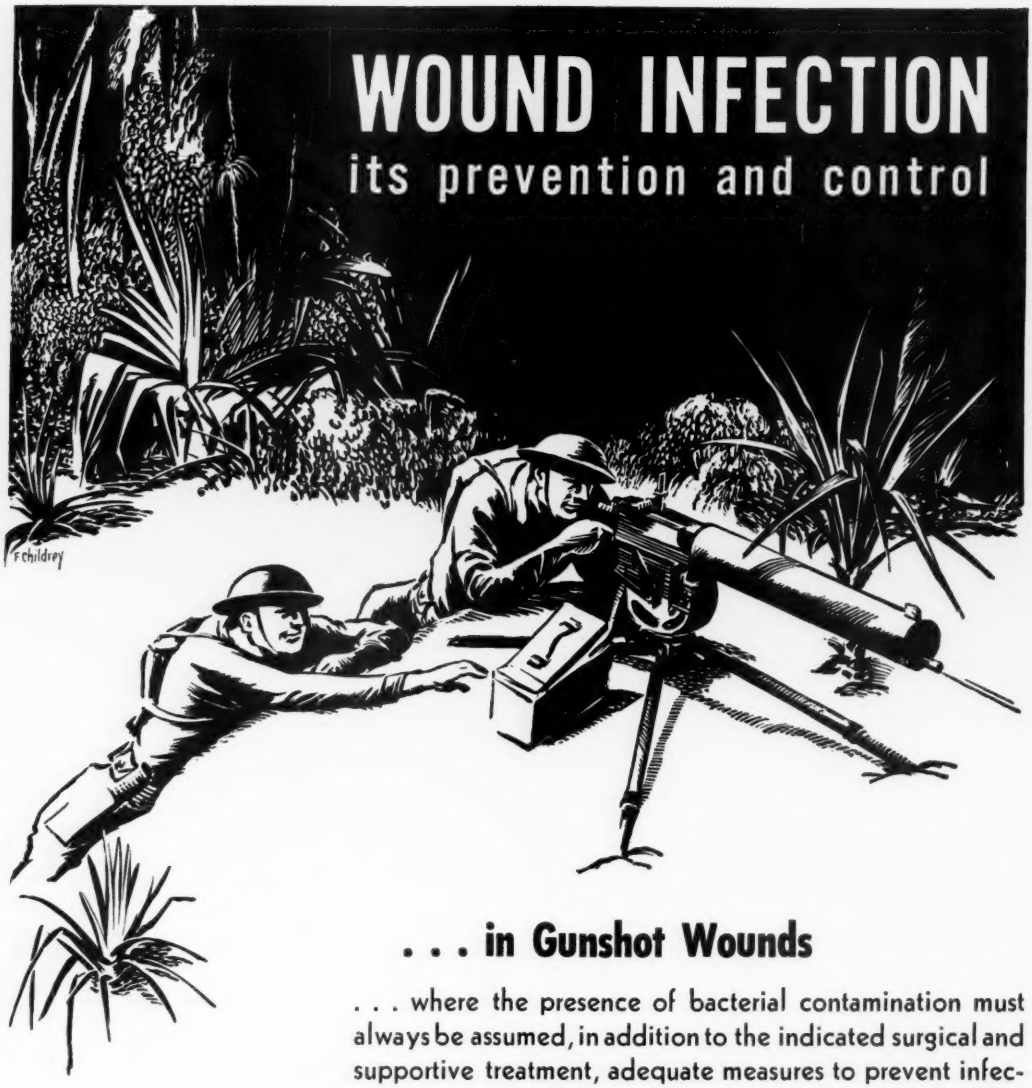

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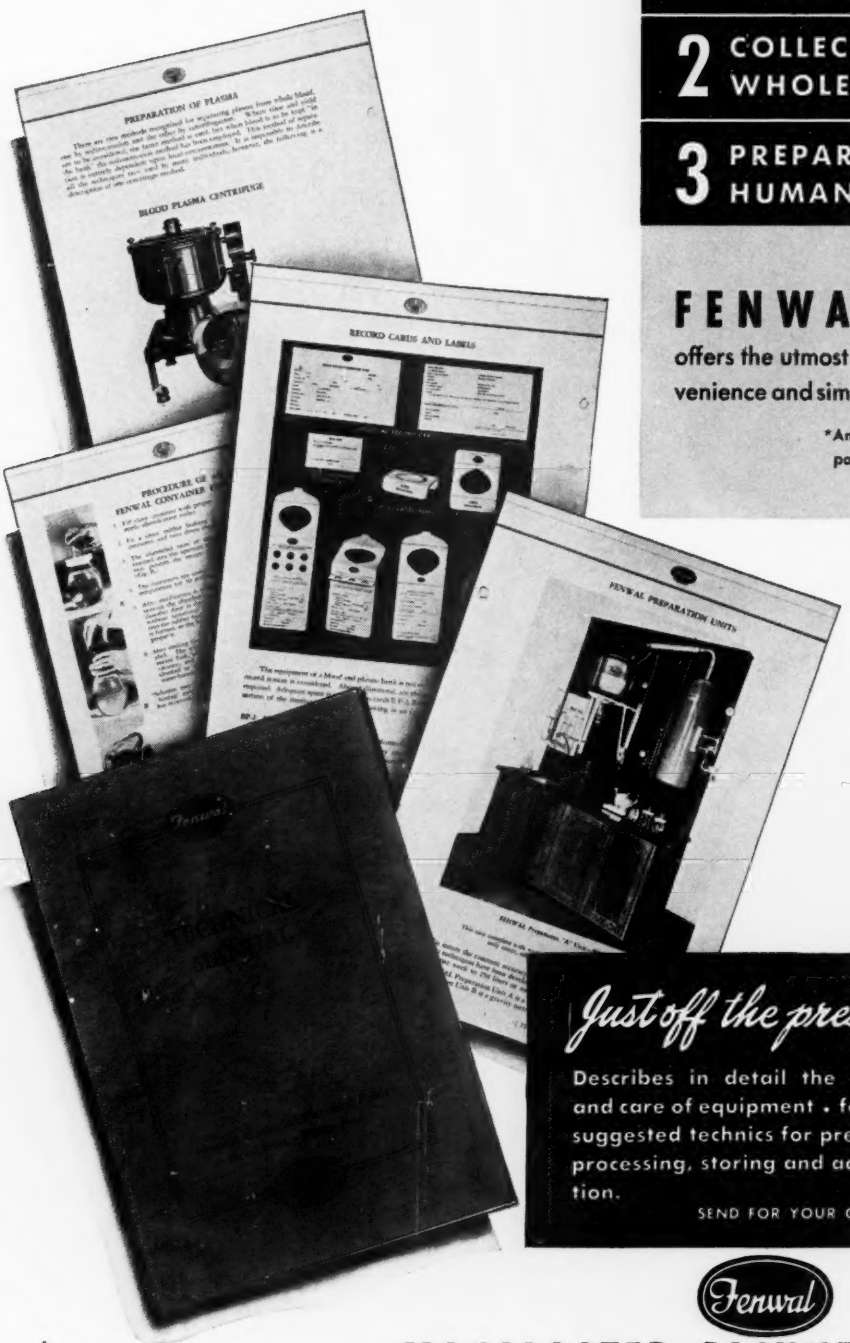

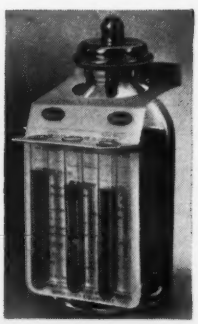

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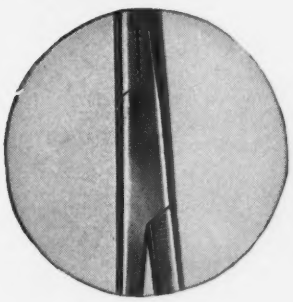

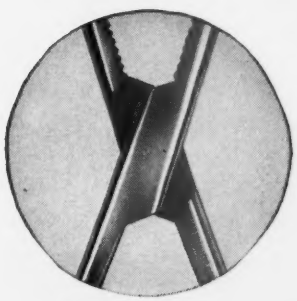

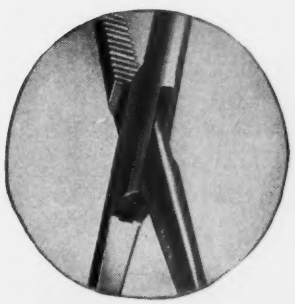

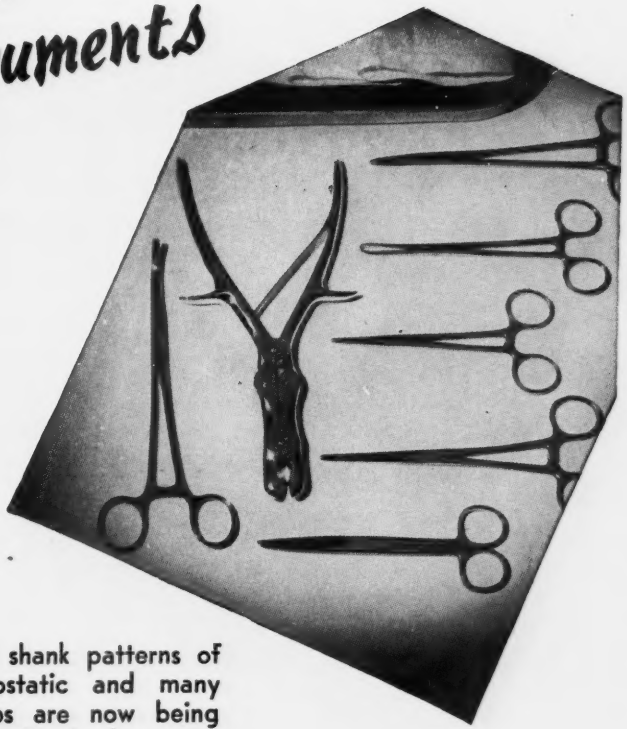

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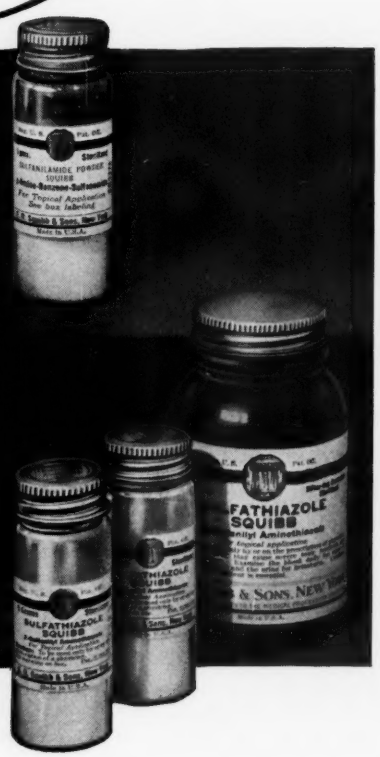

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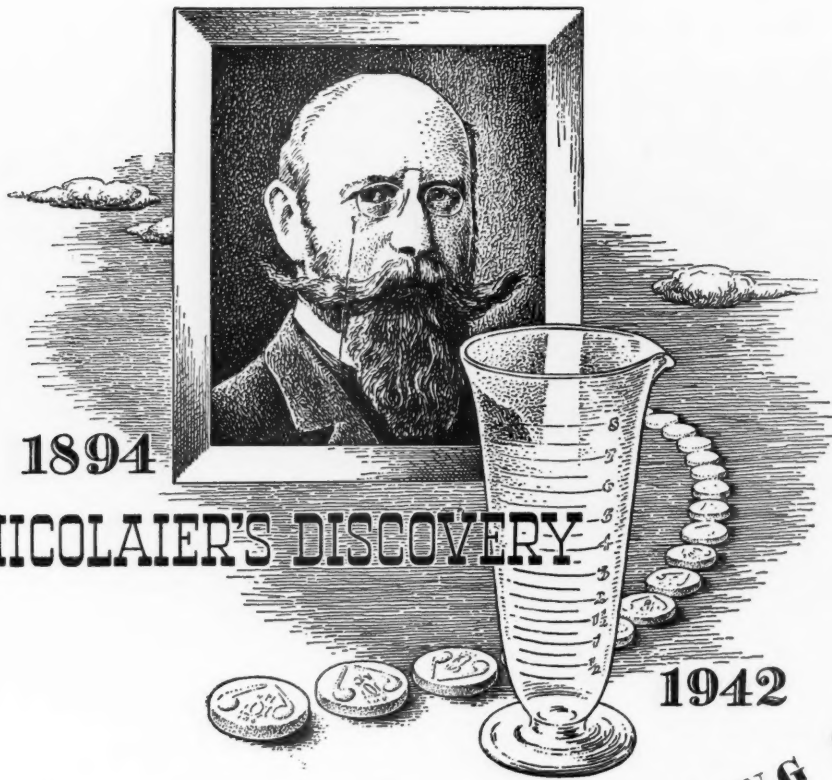

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[1]Lam, C. R.: West Virginia M. J. 38: 215 (June) 1942.

[2]Solandt, D. Y., and Best, C. H.: Lancet 2: 130 (July 16) 1938.

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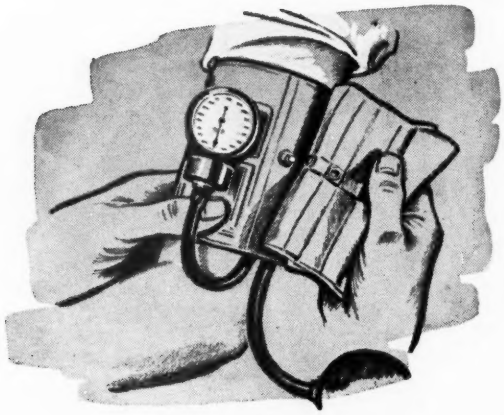

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Editorials

THE PROBLEM OF PERITONEAL DRAINAGE

HILTON said, "It would be well, I think, if the surgeon would fix upon his memory, as the first professional thought which should accompany him in the course of his daily occupation, this physiological truth—that Nature has a constant tendency to repair the injuries to which her structures may have been subjected, whether those injuries be the result of fatigue or exhaustion, of inflammation or accident. Also that *this reparative power becomes at once most conspicuous when the disturbing cause has been removed;* thus presenting to the consideration of the physician and surgeon a constantly recurring and sound principle for his guidance in his professional practice."

The above paragraph was not written from the point of view of adequate therapy for peritonitis, because abdominal surgery scarcely existed in the days of Hilton, but the principle expressed may well be applied to intra-abdominal infectious lesions. It suggests that once the disturbing cause is removed Nature may well do the rest. Thus the removal of the diseased appendix, gallbladder, or devitalized bowel in strangulation might give sufficient relief for Nature, unaided and unimpeded, to accomplish the remainder of the recovery. The use of drains began long before the surgeon knew of the existence of bacteria and was emboldened by his knowledge of bacteria and aseptic methods to open the abdomen at will. The use of drains came from empiricism not science and yet was carried over bodily into the scientific era.

Now the question of drainage in peritonitis has become a major problem for the surgeon. Indeed, it is perhaps more of a controversial problem than ever before, and yet this matter of drainage is as old as surgery and has been discussed by our leaders from the very beginnings of surgical practice. Lord Lister carefully discussed the advantages of the primary closure of compound fractures. He based his reasoning for omitting drains on carefully conducted pathological experiments. The matter of nondrainage of infections in the peritoneal cavity was reintroduced as long ago as 1924 by Sir Henry Gray who, fresh from his experience in the Great War of 1914 to 1918, found further support to his prewar experience of omitting drains in cases of peritonitis following acute appendicitis. He initimated, as did Hilton, that surgeons rarely give enough credit to a patient's natural recuperative powers. He described in detail his own technic for dealing with intraperitoneal infection and abscesses, showing that patients suffering from this malady did better if the drains were omitted. He extended his observations concerning nondrainage in appendicitis to peritonitis from other causes such as perforated ulcer or primary pneumococcal peritonitis. In further support of this point of view is the fact that in the days when

typhoid fever was rampant, ruptures of the ileum were closed without drainage.

Now we are face to face with this issue of the use of drains in the peritoneal cavity. The advocates of drainage and nondrainage bitterly oppose each other, basing their conclusions more on limited personal experience than on a scientific study of the immunological and pathological reactions which occur. Thus a surgeon who drains patients with appendicitis cites how all but 1 or 2 per cent recover and does not take into consideration the fact that perhaps a great number would have recovered if he had not left the drains in place. No experienced surgeon should lay down fixed rules for the care of sick people in the hands of another surgeon, but we have a right to suggest that the removal of the cause of intraperitoneal infection is the chief element in recovery and that once this cause has been removed and the resistance of the body augmented by the use of the new sulfa drugs, drains may be considered, as a rule, both dangerous and inadvisable.

Elliott C. Cutler, M.D.

SOCIALIZED MEDICINE

An American medical revolution is on its way declared Michael Evans in the November issue of Coronet magazine. The armed forces are taking approximately one-third of our practicing physicians with the result that some form of socialized medicine is coming into widespread being.

By January 1, 1943, almost every doctor under forty-five and many in the forty-five to fifty-five age group, will be in uniform. The situation for civilians, according to Assistant Surgeon General Mountain, may truly be called desperate.

"What's going to happen to us when we're sick?" millions of Americans are asking.

With 50,000 out of our 181,530 registered physicians in khaki and with the concentration of workers in war-industrial communities, problems are arising which must be met, the Coronet article states emphatically.

The answer may be socialized medicine, which the American Medical Association has been fighting so bitterly for so long. Today, however, the A.M.A. has no choice in the matter. Medical care must be reallocated to care for the needs of civilians. The United States Public Health Service and other federal agencies under Paul V. McNutt, chairman of the Manpower Board, are assigning doctors to towns as they are needed, and the American Medical Association is assisting the government, whether it will or no. Recruiting of physicians for the armed services has been placed in the hands of the A.M.A. and under an arbitrary but technically voluntary basis, it is assigning physicians to specific localities. Federal and federally-sponsored clinics may come too.

The American Medical Association is also calling upon people to take care of themselves, to learn first aid, to see doctors either at a clinic, a hospital or at their offices, if they must. In one West Coast city, the A.M.A. is buying radio time to tell the public *not* to call a doctor unless the need is absolutely imperative.

But these measures, although helpful to some extent make but a little dent in the problem. You cannot drain doctors out of the population at the present rate and expect to escape the consequences.

Socialized medicine isn't here—yet, says Michael Evans; but what is being done by the government with the cooperation of the A.M.A. is closer to it than anything the United States has seen before, and it is obvious that revolution is taking place in medicine today. Whether or not the change will leave its mark on the medicine of the future is still a question, but it is one that is being answered—now!

Original Articles

ABDOMINAL CARDIECTOMY OR SUBTOTAL GASTRIC RESECTION FOR CANCER OF THE PROXIMAL HALF OF THE STOMACH*

CASE REPORT

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AND

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IN years past, one of the necessary criteria for resectability of a gastric cancer was subtotal involvement of the stomach with freedom of the cardia. This dictum, stated by William Welch in 1885, four years after Billroth had performed the first successful partial gastrectomy for cancer, remained practically inviolate through two successive generations of surgeons. Sporadic attempts at surgical removal of the proximal half of the stomach were initiated by Biondi, who in 1896 first attempted the transthoracic approach. Through a thoracotomy, he freed the terminal esophagus at the hiatus and after delivery of the stomach into the thorax, effected a resection of the cancerous segment and an intrathoracic esophagogastric anastomosis. Chiefly during the last decade, intrepid European and American surgeons have boldly attacked the problem of cancer of the gastric cardia, and by mastering the many difficulties in surgical technic inherent in this location, have brought these 8 to 10 per cent of gastric cancers into the scope of possible cure.

The twenty-five gastric cancers involving the cardia, which have been surgically removed on the gastric service of the Memorial Hospital during the past three or more years, have been excised by five different technics:

1. *Total Gastrectomy—Sixteen Cases.* Even though the involvement of the stomach was subtotal, the extension of the cancer into the cardia and fundus necessitated a removal of the entire organ. Re-establishment of gastrointestinal continuity was accomplished in fifteen instances by esophagojejunostomies and in one unusual case by an esophagoduodenostomy.

2. *Transthoracic, Transdiaphragmatic Resection of the Terminal Esophagus and Gastric Cardia with Intrathoracic Esophagogastric Anastomoses—Six Cases.* This is the classical procedure described and performed by Sauerbruch, Hedblom, Phemister, Ohsawa, Fischer, Carter and others, in which the intact distal half of the stomach is converted into a tube for direct anastomosis with the esophageal stump. The diaphragm is repaired and sutured around the thoracic stomach.

3. *Transthoracic, Transdiaphragmatic Resection of the Terminal Esophagus and Major Portion of the Stomach with Intrathoracic Esophagojejunal Anastomosis—One Case.* This operation, performed by Dr. Gordon McNeer was necessary because of subtotal involvement of the stomach by the cancer.

4. *Transthoracic, Transdiaphragmatic Subtotal Resection of Stomach and Esophagus with a Prethoracic Subcutaneous Esoph-*

* From the Gastric Service of the Memorial Hospital for Cancer and Allied Diseases, New York City.

agoplasty—One Case. So much of the stomach and esophagus was removed that it was impossible to effect an anastomosis within the chest. By multiple-staged operative procedures, the gastrostomy (Janeway) and a prethoracic esophagostomy were united by constructing a subcutaneous dermal tube down the left wall of the chest.

A B

FIG. 1. A, roentgenogram of stomach made prior to operation. The tumor in the cardia may be seen outlined against the gas bubble. B, postoperative roentgenogram. The irregularity along the lesser curvature is the immediate result of suturing with dePetz metal clips. The gastric tube connecting esophagus and pars media has been constructed from the greater curvature of the fundus.

5. Abdominal Cardiectomy or Subtotal Gastric Resection for Cancer of the Proximal Half of the Stomach with Intra-abdominal Esophagogastric Anastomosis—One Case. This case is herein reported.

It is highly desirable, whenever possible to have the line of anastomosis of esophagus and stomach, or esophagus and jejunum as the case may be, below the diaphragm. The repeated successful performance of this anastomosis within the chest by other surgeons and by us, does not contradict the fact that the abdominal anastomosis is safer. Mobilization of the esophagus by freeing it from the diaphragm in order to increase its abdominal extension is commonly done but there are limitations to this maneuver, because of its precarious blood supply and fragility and because of upward invasion by the cancer. Heuer, Andrus and Bell,* being cognizant of these dangers, originated an ingenious two-stage operation in which the transposition of the lower end of the esophagus into the abdomen through the transplantation upward of the left half of the diaphragm, was followed later by the resection of the cancerous segment of esophagus and cardia and an intra-abdominal esophagogastrostomy.

The questions may readily be asked: Why not do a total gastrectomy instead of a subtotal resection of the proximal half of the stomach? Does the preservation of the distal and apparently normal half of the stomach add greatly to the risk of local recurrence? In answer to these queries, one

* Heuer, G. J., Andrus, W. deW. and Bell, H. G. The experimental transplantation of the diaphragm as an adjunct in the treatment of lesions at the lower end of the esophagus. *Ann. Surg.*, pp. 273–286, January, 1925

may remark that surgeons are content to perform partial gastrectomies for cancers in the distal end of the stomach if they are assured by clinical inspection that the upper gastric segment is apparently normal. The partial removal of the upper half of the stomach in the transthoracic, transdiaphragmatic operations is considered the procedure of choice, yet by the abdominal route surgeons believe they are compelled to sacrifice the entire stomach. Our experience with a single case does not warrant the formulation of any rules in this matter, other than to state that the feasibility of the operation of abdominal cardiectomy should be considered. In our three hundred pound patient, a total gastrectomy would have been fatal because his abnormally short jejunal mesentery offered a major obstacle to the construction of an esophagojejunal anastomosis, even by the Roux en-y procedure. The esophagogastric anastomosis functioned in a manner similar to the normal cardia as did the distal half of the stomach with its intact pylorus. The patients who have had total gastrectomies, invariably have some degree of postoperative abdominal discomfort; some have strictures and other mechanical disabilities; many have metabolic deficiencies such as anemia, steatorrhea and inability to gain weight. These attendant sequels should be carefully considered in the elective choice of a total gastrectomy over partial gastrectomy (abdominal cardiectomy) for cancers of the proximal gastric segment.

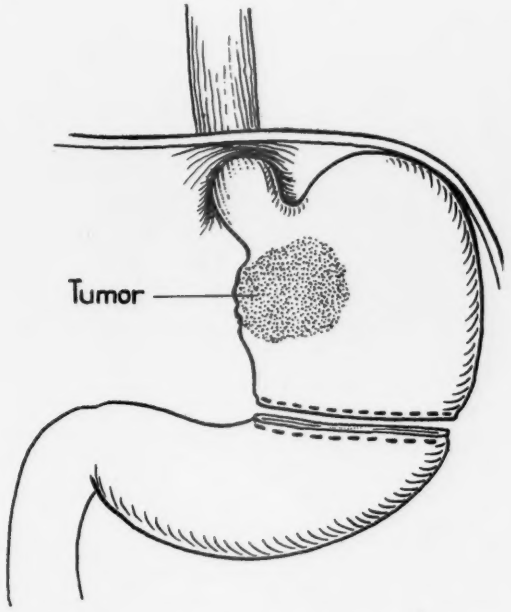


Fig. 2. Gastric cancer situated in region of cardia. Transsection of stomach between two rows of dePetz metal clips, placed distal to the involved segment.

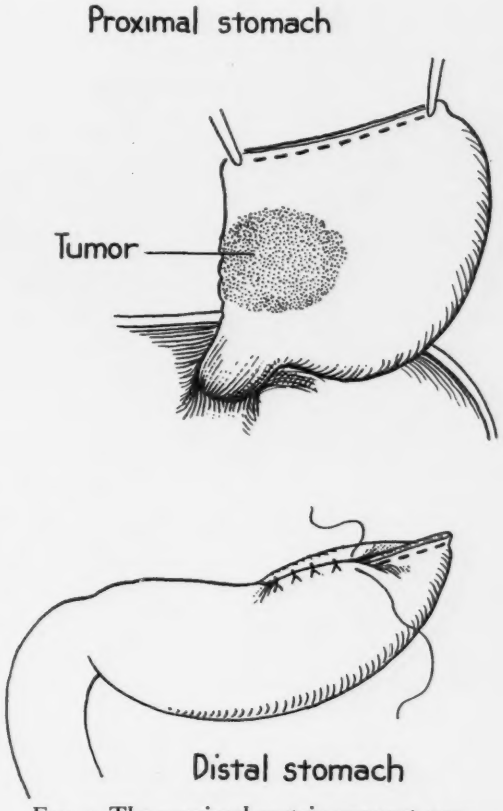


Fig. 3. The proximal gastric segment containing the cancer is elevated to expose the posterior surface of the abdominal esophagus. The distal gastric segment is sutured in preparation of a tube to be used for an esophagogastric anastomosis.

CASE REPORT

M. Z., a fifty-six year old, white, German, married male applied at the Memorial Hospital on April 28, 1941. His father had died following an accidental injury and his mother had died as a result of "rheumatism." Of five siblings, one brother was alive and well, one brother had died of heart disease, and three sisters had died of causes unknown. The patient was a night watchman. In 1916, cranial decompression was done for a shrapnel injury

to his head. His previous health had been otherwise excellent and he had never suffered from indigestion prior to his present illness.

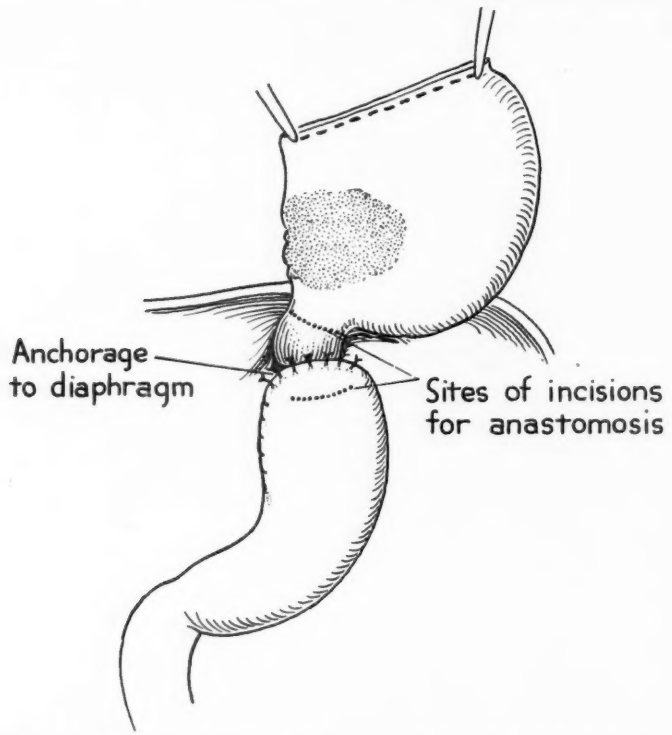


FIG. 4. Diagram showing anchorage of closed gastric tube to the diaphragm and esophagus. Selection of sites of incisions in esophagus and stomach for the anastomosis.

He consumed large quantities of food and drank beer occasionally. His usual weight was 300 pounds.

The onset of symptoms occurred in November, 1940, when he experienced transient cramp-like pains in the upper part of the abdomen immediately after swallowing solid food. This discomfort lasted only a few minutes, presumably until the ingesta had passed into the stomach. During the ensuing five months, the severity of these epigastric pains associated with dysphagia, increased, although he never complained of anorexia, nausea or vomiting. His weight loss of only fifteen pounds was not attended by debility. One week prior to his first hospital visit, he experienced constant pain, mild prostration and the passage of tarry stools continuously for two days. It was this severe hemorrhage which led to his initial gastrointestinal survey.

Physical examination revealed the patient to be an obese white male in late middle life. He weighed 285 pounds. The sclerae were nonicteric; ophthalmoscopy revealed moderate sclerosis of the retinal vessels. The chest was emphysematous; breath sounds were harsh and râles could be heard throughout the lungs. The cardiological consultant observed some myocardial fibrosis and coronary sclerosis. The blood pressure was 170/90 mm. of mercury. The abdomen was pendulous but uniformly soft and without signs of fluid. There were no palpable masses in the abdomen. A bimanual recto-abdominal examination revealed no evidence of metastatic cancer deposit in the rectovesical pouch.

Fluoroscopic examination was unsatisfactory because of the patient's great girth. *X*-ray films of the stomach showed an unusual configuration of the gas bubble shadow associated with an increased density of the soft tissues medial to the gastric cardia. Slight barium retention appeared in the body of the stomach just below the cardia. The presumptive *x*-ray diagnosis was carcinoma of the cardiac segment of the stomach.

The interior of the stomach was visualized through a flexible gastroscope. On the lesser curvature between the incisura and the cardiac orifice, a necrotic ulcer was easily seen. The

cardiac orifice and the distal half of the stomach were of normal appearance.

The urine was acid, contained no albumin nor glucose, and showed good concentration by the Fishberg test. The stools were negative for occult blood. Gastric analysis using the ergamine test revealed an increased free and total acidity, the free hydrochloric acid being as high as 121 degrees forty-five minutes after the injection of ergamine acid phosphate. The hemoglobin registered 100 per cent and the erythrocyte count was 4,740,000 per cu. mm. of blood. The white blood count was 5,100 per cu. mm. with a normal differential distribution. The hematocrit reading was 36 per cent. Chemical analyses of the blood were as follows: blood urea nitrogen—18.8 mg. per cent, blood sugar—104 mg. per cent, bilirubin—0.65 mg. per cent, sodium chloride—639 mg. per cent, total cholesterol—194 mg. per cent, free cholesterol—50.5 mg. per cent, cholesterol esters—143.4 mg. per cent, serum protein—7.1 Gm. per 100 cc., prothrombin—90 per cent and blood vitamin A level—110 U. S. P. units.

The diagnosis was carcinoma of stomach, lesser curvature, juxtacardiac. There were no contraindications to laparotomy. The patient was admitted to the Memorial Hospital on June 4, 1941, and prepared for an abdominal operation.

Operation on June 18, 1941, consisted of subtotal gastric resection (cardia) and esophagogastric anastomosis (abdominal cardiectomy). Under spinal nupercaine anesthesia, supplemented by intravenous pentothal sodium, an upper left midrectus incision was made. The liver was found to be of normal size and consistency without evidence of metastatic cancer. The primary gastric tumor was located in the extreme cardiac segment, closely encroaching upon the terminal esophagus. The tumor was only about 5 cm. in diameter. The involved portion of the stomach could be mobilized readily and the cancer was not adherent posteriorly. After removing the larger part of the great omentum, the gastrohepatic, gastrocolic, gastrosplenic and gastrophrenic ligaments were severed between clamps and ligatures to free the proximal half of the stomach. The coronary and left gastro-epiploic vessels were doubly ligated and severed. A dePetz sewing clamp was now applied across the stomach, approximately in the transverse direction, so that the line of division extended from a point at the junction of the lower and middle thirds of the lesser curvature to a point at the junction of the upper and middle thirds of the greater curvature as indicated in the accompanying diagram. The stomach was then trans-sected between the brads and the distal suture line completely inverted by seromuscular silk sutures.

The mobilization of the proximal or tumor-bearing segment of the stomach was completed with some difficulty. Upward traction of this segment toward the left costal margin in order to expose the posterior wall of the abdominal esophagus after the method of Moynihan was then accomplished. The distal cylindrical gastric tube was then brought up posteriorly and anchored to the diaphragm in order to lessen subsequent tension on the anastomosis, which was to be effected in an end-to-side fashion between the terminal esophagus and

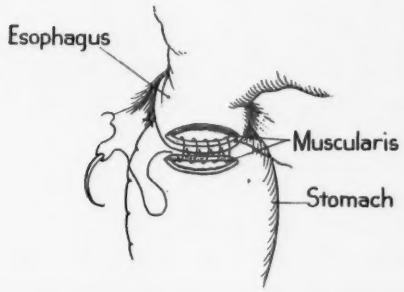


FIG. 5. Diagram to illustrate the technic of anastomosing the esophagus to an incision in the anterior wall of the stomach, i.e., a termino-lateral anastomosis. The incisions are down to but not through the mucosa at this stage.

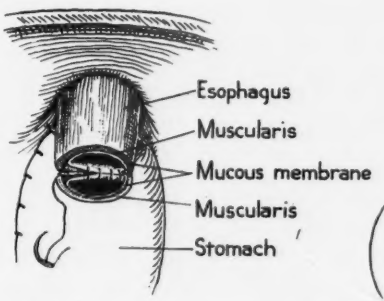


FIG. 6. Completion of posterior layer of anastomosis after deepening incisions through the esophageal and gastric mucosa. The cancer-bearing segment of the stomach has been removed.

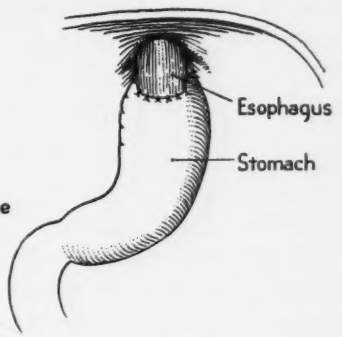


FIG. 7. Diagram illustrating the completed anastomosis.

the anterior wall of the residual stomach. (Fig. 4.) A new stoma was made transversely in the anterior wall of the stomach about 3 cm. below the tip of the gastric tube. The anastomosis was completed by the usual technic with three suture lines posteriorly and two anteriorly, the inner one of which was a Connell inverting suture. A Levin tube was inserted through the nose and directed through the anastomosis before the abdomen was closed. The abdominal wound was closed in layers.

A blood transfusion of 600 cu. cm. was given during the operation and 250 cu. cm. of plasma was administered on the third postoperative day. Convalescence was complicated by a mild bronchopneumonia, controlled by sulfanilamide, and by dehiscence of the wound, requiring secondary closure.

Gross and Microscopical Study of the Surgical Specimen. The posterior wall of the stomach contained an ulcer measuring 5 cm. in diameter, with elevated grayish margin and relatively clean base. The upper margin of the ulcerated tumor involved the cardiac orifice and a portion of the esophagus itself, leaving a stenotic passageway of less than 1 cm. in diameter. The gastric mucosa appeared normal with prominent rugal markings. The adjoined perigastric lymph-nodes were replaced by tumor tissue. On microscopical study, the diagnosis was diffuse adenocarcinoma grade 4, with metastases to multiple (3) juxtacardiac lymph-nodes.

After the patient was ambulatory, he experienced some discomfort from a large incisional hernia. His postoperative weight was 238 pounds and this has remained stationary. He complained of postprandial discomfort in September 1941, and roentgenograms made then showed some irregularity of the reconstructed gastric tube which might be either an operative defect or recurrent carcinoma. Because of the great anaplasia of the tumor, postoperative *x*-ray therapy was administered from which the patient experienced relief of symptoms. The following factors were employed: 1,000,000 volts, filter of 2 mm. Hg., 8 mm. cu., target-skin distance of 70 cm., 3 ma., fields measuring 12 by 16 cm., employing three skin fields, anterior, lateral and posterior. Three hundred roentgens were given daily, alternating until a total dose of 2700 r $\times$ 3 was administered. A recurrence of symptoms occurred in August, 1942, and an additional series of *x*-ray treatments with two-thirds the original dose have just been given.

FISSURE-IN-ANO

EDWARD T. WHITNEY, M.D.
Surgeon-in-charge, Rectal Clinic, Boston Dispensary
BOSTON, MASSACHUSETTS

A TRUE fissure-in-ano is one of the most painful lesions known and even when it has become chronic or is in a remission, there is an underlying pathological condition which is still producing many local and reflex symptoms such as tenderness, splitting at stool, constipation, nervousness and irritability, tension, lack of energy and concentration and an inability to get the mind off the "rectum." It is much more common a condition than is generally supposed. Every sore anus should be considered as harboring an actual or potential fissure until that possibility has been definitely eliminated. Furthermore, recurrences even after surgical intervention are altogether too frequent and nothing is more discouraging than to have a fissure recur after the patient has submitted to some procedure which was supposed to cure him. As Blaisdell[1] has said, heretofore treatment has not been "along logical and scientific lines."

To begin with the term, fissure-in-ano, should be accurately defined. The little splits in malnourished skin at and just outside of the anal verge are not true fissures-in-ano. Neither are the cracks in the bases of pruritic creases. The true fissure-in-ano is intra-anal. Two distinct varieties may be recognized: First, there is the superficial split, abrasion or ulcer occurring anywhere on the anal wall except at the posterior commissure and usually accompanied by some indefinite discomfort only. Second, there is the deep, round or oval ulcer in the anal wall at the posterior commissure producing severe pain at the time of and following a bowel movement. The latter comprise some 90 to 95 per cent of all fissures-in-ano.

The first, superficial type is accompanied by a sore anus but it is only occasionally accompanied by the severe lancinating pain and spasm associated with the second, deep type. Often, the chief complaint is bleeding with tenderness or soreness being elicited only after questioning. Usually, its etiology is fairly easily determined. There are at least four possibilities: (1) a simple split, laceration or abrasion from a constipated stool or foreign body; (2) the rupture of a small thrombosis low down on the anal wall; (3) a split of the intra-anal skin overlying an area of fixed scar tissue occurring either anteriorly, as the result of parturition, or elsewhere, as the result of chronic, inflammatory "cryptitis" and (4) a ruptured but inadequately draining, infected anal duct or "crypt" much like that to be described later on but not involved in the complications so often existing at the posterior commissure. Treatment of such a fissure depends upon ascertaining the existing, underlying, causative factors and eliminating them.

It is the second type which produces the typical, severe and agonizing pain recurring with each bowel movement and lasting for some time thereafter. This pain may be so acute that bowel movements are withheld for days. The victim becomes driven; he can neither sit still nor stand still. When fear of examination prevents medical assistance, a distinct loss of weight may occur. After a few days or weeks under palliative measures this acute stage may quiet down and become chronic or healing may even take place only to be followed by recurrences. Upon examination, it may be impossible to find anything beyond spasm of the sphincter so marked that introduction of the finger into the anus is prevented. However, in the majority of cases, a little edamatous "sentinel pile" will be seen and if this is retracted the distal tip of the

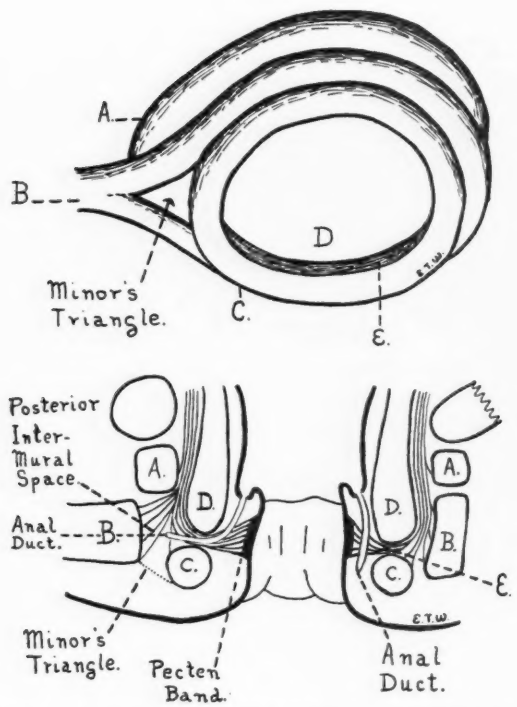


FIG. 1. Diagrams illustrating the various parts of the sphincters. The top one is a modification of the conceptions of Milligan and Morgan and of Blaisdell. The view is as if one were looking into the rectum through the dilated sphincter with the skin and mucous membrane removed. Through the opening is seen the muscular wall of the rectum, the lower end of which is called the internal sphincter (D) while the opening itself is formed by the subcutaneous portion of the external sphincter (C). Between the two is illustrated the intermuscular septum composed of strands of longitudinal muscle (E). The superficial portion of the external sphincter (B) is shown forming Minor's triangle as it goes off at a tangent to become attached to the coccyx. The deep portion of the external sphincter (A) is behind this.

The lower diagram illustrates a sagittal section of the top view with the skin and mucous membrane intact. The lettering is the same. (A) is the deep portion of the external sphincter; (B) is the superficial portion of the external sphincter; (C) is the subcutaneous portion of the external sphincter; (D) is the internal sphincter and (E) is the longitudinal muscle coming down the outside of the rectum with some of it passing through the intermuscular septum to become attached to the anal skin in that location. The left half of the diagram is at the posterior commissure and shows a crypt of Morgagni into which an anal duct empties with its tip lying in the intermuscular septum. The right half depicts the usual location of an anal duct not at the posterior commissure.

fissure may be visualized. After relaxation of the sphincter is obtained and a speculum inserted, the fissure will be found to be round or oval and the base will be seen to be composed of either firm, white, fibromuscular tissue[2] or the external sphincter[1,3] or both. In other words, except while the contracted anus is pinching it together, it is not a fissure at all but rather an ulcer in or through the intra-anal skin.

This second type occurs only at the posterior commissure and this fact calls for careful examination of any especial conditions or pathological condition existing solely in the latter region. There are three such factors which require consideration, two of them are pathological and one is anatomical. The first and most important pathological entity to be found in this region is the presence of or the remains of an infected anal gland or "crypt" (so-called). This, in turn, affects and is affected by a pathological structure commonly known as the Pecten band. However, both of these factors may be found present elsewhere in the anus and only rarely do they produce any such syndrome of signs and symptoms. *It is the peculiar anatomy of the sphincters existing only at the posterior commissure in which the infected anal gland becomes involved following the production of the Pecten band that produces the true posterior commissure fissure.*

The anatomy of the sphincters will be considered first. It is not so simple as is often illustrated. The external sphincter surrounds the internal sphincter both laterally and distally and it is divided into three parts called the subcutaneous, the superficial and the deep. The subcutaneous and deep portions make complete circles. (Fig. 1.) The middle portion, i.e., the superficial, after encircling the anterior and lateral portions of the anus, turns off at a tangent on each side to form a Y, the single leg of which becomes attached to the coccyx.[1,2,3] Between the bilateral legs of the Y, there is a V-shaped space which is called Minor's triangle.[4] (Fig. 1.) It really should be called Minor's triangular or prismatic

space. This space is also called the posterior intermural space. It is bounded on all sides by the sphincter muscles although it can be entered from the anus through the intermuscular septum which is a slit-like window between the internal sphincter and the subcutaneous portion of the external sphincter. It is normally filled with a few decussating fibers of the external sphincter plus some fibromuscular strands from the longitudinal muscular coat of the rectum and connective and areolar tissues. This Y-shaped separation of the superficial external sphincter muscle at the posterior commissure can be definitely palpated, in the normal person, as a depression between the internal sphincter and the subcutaneous portion of the external sphincter.

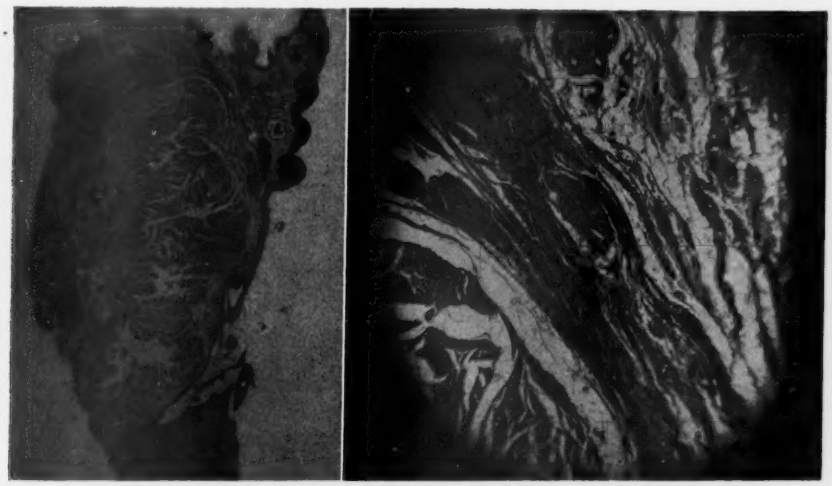


Fig. 2. The left photograph (× 4) illustrates a sagittal section of the subcutaneous portion of the external sphincter at the posterior commissure with some of the longitudinal muscle coming through the intermuscular septum just below *x* to become attached to the intra-anal skin opposite. A crypt of Morgagni with the upper portions of an anal duct can be seen at the upper right. In this section, all of the tissues in the latter location are quite markedly contracted and thus pulled down nearer to the external sphincter than they are in the natural state. The right photograph (× 100) shows more in detail this longitudinal muscle seen just below *x* in the left photograph.

The Pecten band is a pathological collar of inelastic fibromuscular tissue in the submucosa immediately overlying the intermuscular septum. It was first mentioned by Miles, in 1918, but was more adequately described by Abel[5] in 1932. In 1934, Milligan and Morgan[3] in their admirable description of the anatomy of the anal canal, stated that the internal sphincter was separated from the subcutaneous portion of the external sphincter by an "annular band of fascia" which was attached to the intra-anal skin at the sulcus between the internal and external hemorrhoidal areas. They called this "band of fascia" the intermuscular fascia. Daniels,[6] in 1936, concluded that Abel's Pecten band and an hypertrophied or fibrosed intermuscular septum were the same thing.

We wish to amplify and correlate all of the foregoing conclusions and observations. Levy[7] as well as Milligan and Morgan[3] have shown how the longitudinal muscle comes down the outside wall of the rectum, ensheaths the various portions of the external sphincter and then becomes attached to the skin at the anal verge and in the intra-anal area at the intermuscular septum. (Figs. 1 and 2.) The fibers of this muscle, in the latter location, take on the characteristics of both smooth muscle and connective tissue, i.e., it is fibromuscular.[3] In the presence of inflammation the connective tissue elements become preponderant to the exclusion of muscular elements especially in the region of the intermuscular septum.

In this way a definitely palpable band of fibrous tissue is produced which is called the Pecten band. (Fig. 3.)

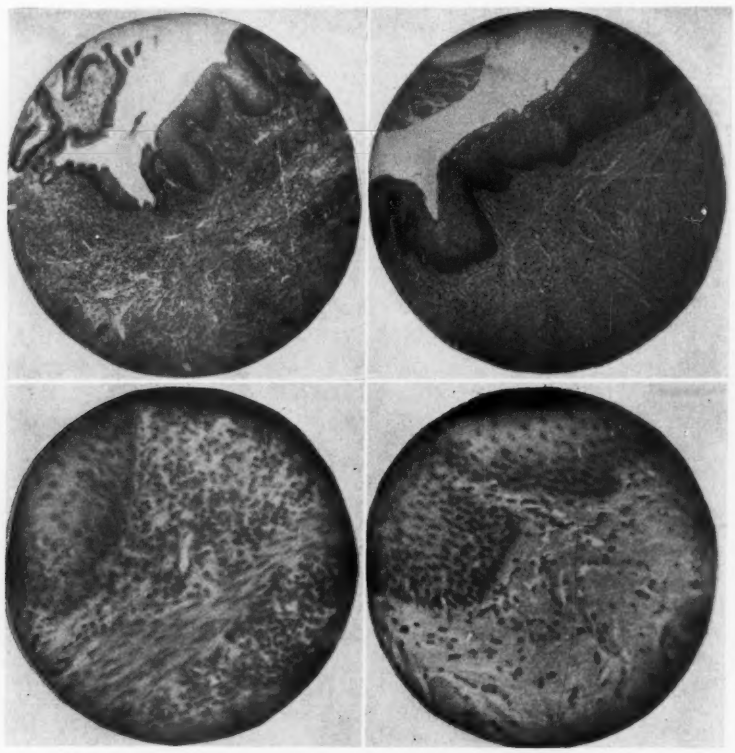
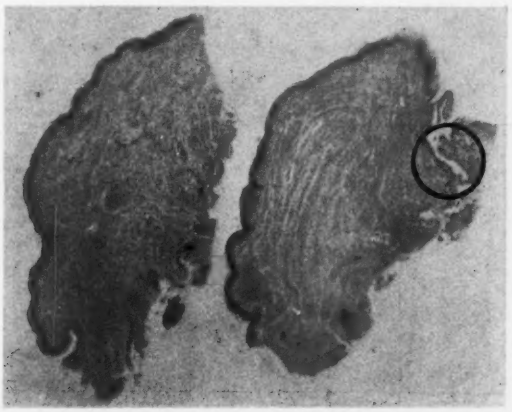


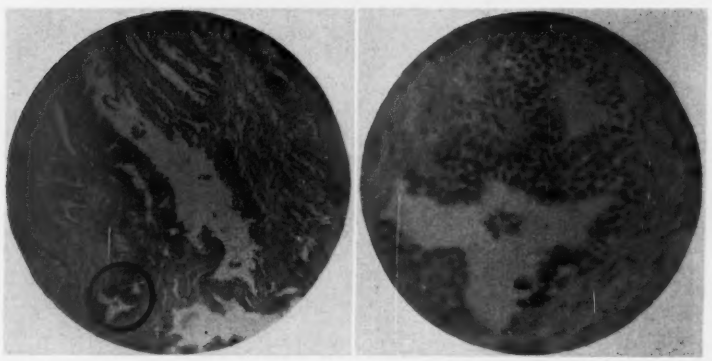
Fig. 3. Illustrating the comparison in the character of normal longitudinal muscle at its insertion into the anal skin with what it is when it has been changed into a Pecten band through fibrosis and hypertrophy. The upper left photograph (× 100) shows a strand of longitudinal muscle excised during a hemorrhoidectomy. The lower left (× 300) depicts more in detail the fibromuscular character of this longitudinal muscle. In this section it is quite obviously muscle but sometimes it is hard to say whether it is connective tissue or muscle. In contrast, the upper right photograph (× 100) was taken from a Pecten band and the nature of the dense fibrosis and hypertrophy is seen both in this view and in the high power one below it (× 300).

The third provocative or explosive factor in the causation of a posterior fissure-in-ano, is an infected anal gland or "crypt." The closure of the anus is accomplished by the tonic contraction of the two sphincters. This constriction throws the anal skin and mucous membrane into a number of folds between which there are an equal number of depressions, the lower ends of which terminate in cup-shaped pockets called the crypts of Morgagni. These crypts of Morgagni occur at the pectinate or mucocutaneous line which is at the level of the internal sphincter. In many human beings are to be found some little glands lying beneath the skin of the anus and emptied by ducts which travel upward and open into these crypts of Morgagni. (Fig. 4.) These glands have been admirably described and illustrated by Tucker and Hellwig[8] and more recently by M. R. Hill, E. H. Shyrock and F. G. ReBell. They are lined with epithelium and are similar to the para-urethral glands and the glands within the tonsil. As a rule, with some exceptions, we have found them to occur in the adult at twelve, four and eight o'clock, the posterior commissure being twelve o'clock (Blaisdell[1] says five, seven and eleven). It is not uncommon for them to become infected and when this occurs, portions of the epithelium are destroyed, allowing extension of the infection into the surrounding tissues. This

extension is combatted by a walling-off with leucocytes and round cells, the latter being replaced by connective tissue. Subsequently, the epithelium regenerates but the reconstructed duct is larger, more racemose and less glandular. Furthermore, it is surrounded by fibrous tissue. This fibrosis involves not only the immediate region of the duct but also stimulates the production of the Pecten band as described above. In fact, it is our belief that a Pecten band only occurs secondarily to infection of these anal glands. Contraction of this band about the duct or neck of such a gland obliterates the latter so that further extension of the burrowing is fostered. This burrowing follows the line of least resistance which, except at the posterior commissure, is usually downward between the intra-anal skin and the external sphincter and often the pressure within the duct is great enough to push out the very elastic skin at the anal verge[9,10] so that an anal protrusion is produced which we have called a cryptic



A



B C

FIG. 4. Illustrating an infected anal duct behind a Pecten band. A, (× 4) shows two sections of a Pecten band the right one containing (within the circle) part of an anal duct just as it empties into a crypt of Morgagni. The width and density of the fibrosis in this specimen is marked but not extraordinary. The anal duct goes off toward the intermuscular septum and Minor's triangular space at a 45° angle to the anal wall. B, (× 100) shows a low power view of this same anal duct. Note how racemose it is, also how thin the epithelium is in places (one cell in thickness directly to the right of the circle). C, (× 300) is a high powered view of that much of which is encircled. In it can be studied in detail the transitional epithelium lining the wall of the duct and the fibrosis surrounding it.

tab.*,9 However, at the posterior commissure these anal glands either lie with their tips in the intermuscular septum or in at the posterior commissure lies within the fibers of the longitudinal muscle in the intermuscular septum between the two legs

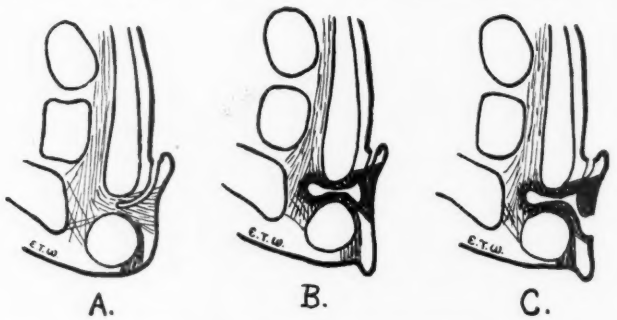


FIG. 5. Diagrams illustrating our conception of the three steps in the pathogenesis of a fissure-in-ano. In (A) an anal duct is shown lying in the intermuscular septum at the posterior commissure. In (B) this anal duct has become infected and has become walled off by fibrous tissue which in turn has strangulated and obliterated the duct in the region of the Pecten band. An abscess burrowing back into Minor's triangular space and down the anal wall is the result. In (C) this abscess has ruptured through a buttonhole opening in the Pecten band and through the anal skin to form the fissure-in-ano (so-called). This diagram is somewhat exaggerated as the abscess does not always extend as far back into Minor's triangular space as is here illustrated. (See Fig. 6.)

Minor's triangular space, or, as they become infected, the line of least resistance is backward toward the latter so that, in either case, infection travels back through the septum toward or into Minor's triangular space (Fig. 4) where it is surrounded on all sides by sphincter muscles except that side filled up by the Pecten band. (Fig. 5.)

It will, therefore, be seen that an infected anal gland at the posterior commissure not only becomes ensnared in the fibrous complications of its own making but also becomes entangled in the peculiar anatomical surroundings existing only in that location. To recapitulate, originally an anal gland of the superficial external sphincter as they go off at a tangent to become attached to the coccyx. Upon becoming infected, it stimulates the fibrosis and hypertrophy of the longitudinal muscle, thereby producing the Pecten band which in turn strangulates its neck. Burrowing takes place but unless escape through Minor's space in the form of a fistula is had, a little abscess is formed surrounded on all sides by sphincter muscles and the Pecten band. (Figs. 5 and 6.) Anything which increases the pressure on this little confined abscess will cause pain and this pressure is decidedly increased by defecation. In fact, during this act, some of the infected material is most certainly squeezed into the sphincter muscles, thereby producing not only the characteristic pain but the spasm as well. The rest of this infected material is suddenly propelled through some small buttonhole rupture in the Pecten band after which it bursts through the very thin intra-anal skin to form the fissure-in-ano. (Figs. 5 and 6.) In several cases we have been able to identify, with a right angled

* By common usage these anal glands have somewhat erroneously come to be called "crypts" and when infected the condition has been called "cryptitis." However, even though this nomenclature is somewhat erroneous, as "crypt" and "cryptitis" are shorter and more euphoneous terms than anal gland and anal glanditis, the former will probably continue to be used in preference to the latter. It is not until an anal gland has become enlarged by infection that it can be discovered clinically by entering it with a crypt hook so that when the term "crypt" is used an *infected* anal gland is the entity usually referred to. In contradistinction the crypts of Morgagni are so designated.

hook, the little buttonhole opening through the Pecten band in the base of the ulcer from which pus could be expressed. However, as this opening is very small and as it promptly closes up again, pressure builds up anew in the little abscess only to reproduce the symptoms all over again whenever defecation is once more attempted. Just how far back this little abscess burrows, is hard to say. It probably varies with the individual. In some subacute fissures of weeks' duration, we have found dense, white, indurative scar tissue for half an inch or more back into Minor's triangular space. Occasionally, the typical pain and spasm of a fissure exists but no fissure can be found, in which case the contents of the gland are apparently unable to find any outlet at all. Marked tenderness over Minor's triangular space, however, is present and adequate treatment as for a fissure-in-ano will produce a cure.

If this condition is allowed to become chronic or even to heal spontaneously, more fibrosis occurs, the Pecten band grows thicker and stronger and the sphincters become inelastic and pulled back onto the coccyx. Even if the original abscess and its fissurous opening become completely obliterated by scar tissue, the seeds for future trouble have been planted, as the intra-anal skin over this fixed fibrosed portion of the anal wall becomes a prey to splitting and abrasion. Its blood supply becomes inadequate and atrophy occurs. Contraction of a Pecten band over the course of many years produces a "contracted anus" not too rarely seen in elderly people.

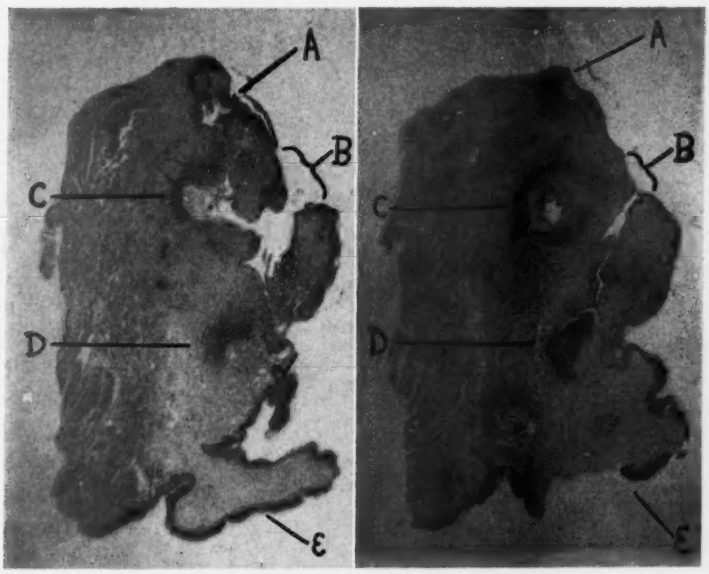


Fig. 6. Photographs of two serial slides selected from a number made from a sagittal section of an old, recurrent fissure-in-ano and its base at the posterior commissure (× 4). (A) indicates the erstwhile opening of the anal duct. (B) is the "fissure" behind which is a buttonhole opening into the abscess (C). Some extension of the infection down the anal wall is seen at (D) while (E) is the "sentinel pile."

Several therapeutic procedures designed for alleviation of this type of fissure-in-ano have been evolved but recurrence follows many of them for the reason that the underlying pathological condition has not been removed. The manner whereby each one of these procedures accomplishes its purpose and the reason why recurrence is a frequent sequel may be seen if each procedure is examined in the light of its effect upon the underlying condition: (1) Manual dilatation, under a general anesthetic, increases the drainage from the abscessed gland by temporarily enlarging the button-

hole opening, eliminating the spasm of the sphincters and temporarily loosening or breaking down some of the fibrosis; (2) cauterization unless deep, does no more; (3) an injection of an anesthetic in oil beneath the fissure simply prevents pain and eliminates spasm allowing temporary healing in some cases. However, following none of these methods has obliteration of the gland been accomplished while the fibrosis and the Pecten band still exist or are soon reformed. (4) Excision of the fissure will be successful only if this excision happens to include some or all of the gland or if some or all of the Pecten band is accidently incised. (5) Incision of the Pecten band, either through the base of the fissure or elsewhere, is theoretically promising but we personally have had recurrences even following this operation. Apparently both the gland and the Pecten band regenerated.

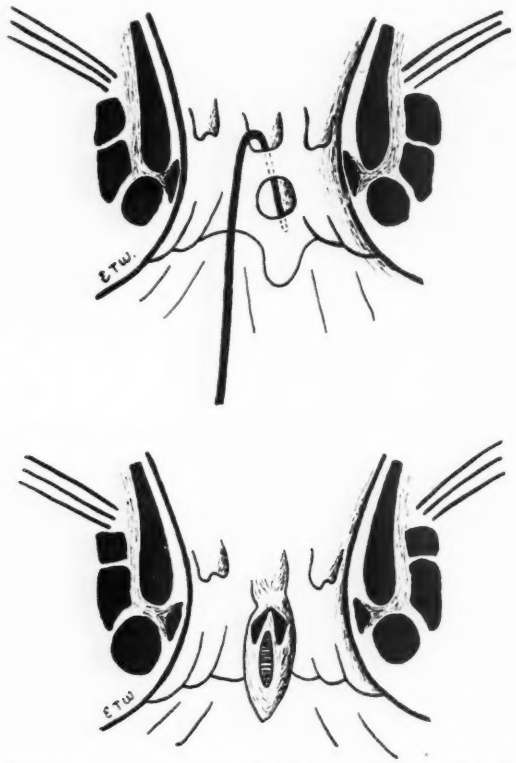


FIG. 7. Diagrams illustrating the two steps in the operation for fissure-in-ano. The upper diagram shows the crypt hook lying in the anal duct behind the Pecten band, behind the "fissure" and in the "sentinel pile." After the hook has been pulled forward, all of the structures on it are excised with the scissors with the result as shown in the lower diagram. Then a posterior sphincterotomy is done whereby the scalpel incises the subcutaneous portion of the external sphincter, the fibers of which can be seen in the base of the excised wound in the lower diagram. The first step has severed most of the Pecten band leaving a few hard fibers at its upper edge. These must be incised when the posterior sphincterotomy is done so that the base of the wound is all soft, muscle tissue. Finally, the skin edges on the buttock are trimmed away. No sutures are used except for ties as drainage and granulation from the bottom is desired.

It will, therefore, be seen that in order to secure a radical and permanent cure, three ends must be achieved, namely, as much of the anal gland must be excised as is possible; the Pecten band must be completely incised and its regeneration prevented by separation of the severed parts long enough for resolution to begin and adequate drainage of the intermuscular septum at the posterior commissure and of Minor's triangular space must be obtained and maintained until granulations eradicate any vestiges of crypt remaining in either of those regions.

Two fairly simple operative procedures done under novocaine and oil anesthesia will accomplish the desired results. The first one is a cryptectomy whereby the anal duct together with the papillas, fissure and the "sentinel pile" are picked up on a crypt hook and excised in one piece. (Fig. 7.) As the duct runs down through or beneath the Pecten band, this procedure will of necessity also partially incise the latter. This eliminates much of the underlying pathological condition except what is back in Minor's triangular space. Then in order to obtain adequate drainage of the latter, a posterior sphincterotomy is performed such as has been advocated by Mulligan and Morgan,[3] Blaisdell,[1] Gorsch[11] and Daniels.[6] In this operation, the whole of the subcutaneous portion of the external sphincter is incised at the posterior commissure together with any remaining fibers of the Pecten band. This posterior sphincterotomy is very important. Not to do it is to court either recurrence of the fissure or production of a blind fistula[1] going back at

a right angle through the intermuscular septum into Minor's triangular space. Finally, all overlapping edges of skin are cut back, a penrose drain is inserted and a pressure bandage applied. The drain is removed in twenty-four hours. A few days of hospitalization is all that is usually necessary. The sphincter ends become reapposed fairly rapidly and full healing takes place in from two to four weeks depending upon the amount of skin excised. In an early acute fissure with little fibrosis only a small amount of skin need be removed, but in an old or recurrent case with a thick Pecten band, wide excision of skin will prevent healing long enough for resolution of the fibrosis to take place and a slightly funnel-shaped anus (from without, in) will result. The indirect effects of this operation are often remarkable. The anxious appearance vanishes, color returns to the cheeks, vague reflex aches and pains disappear, cheerfulness and calm succeed fault-finding and irritability and in many cases a long standing constipation is corrected.

SUMMARY

The syndrome of acute symptoms accompanying a true fissure-in-ano at the posterior commissure has long called for a logical and scientific explanation but it was not until the last few years that the presence of infected anal glands and the Pecten band was recognized and the intricate anatomy of the anal sphincters is still a subject for study.

It is shown how all three of these factors are involved in the genesis of a fissure-in-ano. An anal gland becomes a prey to infection which ultimately is combatted by the production of fibrous tissue especially in the neighborhood of the fibromuscular longitudinal muscle. Fibrosis of the latter results in a Pecten band which strangulates the duct or neck of the gland thereby producing an intersphincteric abscess. Rupture of the latter through the anal wall creates a round or oval ulcer which when the anus is not dilated, looks like a fissure or crack.

Logical treatment requires elimination of the underlying causative condition. This is accomplished by excision of the infected anal gland, incision of the Pecten band and adequate drainage of the abscess by means of a posterior sphincterotomy.

REFERENCES

1. Blaisell, P. C. Pathogenesis of anal fissure and implications as to treatment. *Surg., Gynec. & Obst.*, 65: 672–677, 1937.
2. Morgan, J. W. Pectenosis and minor maladies of the anal region. *Surg., Gynec. & Obst.*, 59: 806–809, 1934.
3. Milligan, E. T. C. and Morgan, C. N. Surgical anatomy of the anal canal. *Lancet*, 2: 1150, 1934.
4. Minor, W. C. Proctotomy with implantation for contraction of anal canal. *Med. Herald*, 46: 155–160, 1928.
5. Abel, A. L. The pecten: the pecten band: pectenosis and pectenotomy. *Lancet*, 1: 714–817, 1932.
6. Daniels, E. A. Anal fissure, anal spasm and anal stenosis. *Am. J. Digest. Dis. & Nutrition*, 3: 775–783, 1936.
7. Levy, E. Anorectal musculature. *Am. J. Surg.*, 34: 141–198, 1936.
8. Tucker, C. C. and Hellwig, C. A. Histopathology of the anal crypts. *Tr. Am. Proc. Soc.*, 47–52. 1933.
9. Whitney, E. T. and Keane, J. F. Perianal cryptic tabs. *New England J. Med.*, 221: 303–306, 1939.
10. Drueck, C. Cryptitis. *Illinois Med. J.*, 71: 528–531, 1937.
11. Gorsch, R. V. Fissure-in-ano, its pathogenesis and treatment. *Med. World*, 56: 300–320, 1938.

PILONIDAL CYST*

REPORT OF A NEW PROCEDURE FOR OPERATION AND TREATMENT

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WE believe we have produced a procedure for operation and treatment of pilonidal cyst which has materially reduced the healing time. The purpose of this paper is to present experiences gained in the treatment of thirty patients. The study was undertaken because previous methods were not satisfactory for use in the military service.

In the military service the problem of pilonidal cyst is a prominent one. Following operation it is the general policy that the soldier shall not be returned to duty until convalescence is complete. For example, the soldier cannot do duty while he has an open granulating wound and return to the dispensary for periodic dressings. Therefore, the surgeon is confronted with the maintenance of the patient in the hospital until the wound is solidly healed.

The incidence of pilonidal cysts is high in the army. This may be expected because the recruits are in the proper age group and incidence is higher in males. Mild to moderate trauma is inherent in the occupation and exigencies of modern military methods. The type of trauma may range from that gotten from vigorous calisthenics to direct injury incurred from riding over rough terrain in trucks. Trauma as a predecessor of infection draws attention to the presence of a cyst. In this series moderate to severe infection was present in all cysts operated upon. During the First Army Maneuvers in the Carolinas, 33 per cent of the admissions to the Septic Surgical Service at this hospital were actually pilonidal abscesses. Often the cavities had been extended by infection beyond the confines of the cyst wall and over the buttocks. The methods previously used were variations of block excision. They were: (1) block excision packed open to granulate in; (2) block excision with mattress suture closure with sulfanilamide powder in the wound; or (3) closure where various types of relaxing incisions had been made to close the wound without tension. None of these methods was entirely satisfactory primarily because of the prolonged healing time and also because of complications which were inherent in healing of a scar in the midline crease.

Consequently, in order to establish a procedure which would be more ideal we set down the following aims: First, we attempted to devise a method by which we could be more certain of excising all the abnormal and infected tissue. This meant a procedure by which a more anatomical dissection could be done with better visualization of the sac structure. Second, we sought for a method to facilitate healing and reduce hospitalization to a minimum. In general to accomplish this end meant finding a substance which would not only reduce the possibility of infection but would also stimulate healing. Third, we endeavored to leave the soldier with a solidly healed scar which would be least likely to break down. We believed that this latter aim could best be accomplished by reducing the need for new epithelium by retaining the original thick skin.

EXCISION

Block excision by sharp dissection or with cautery, with or without closure, has been the most popular procedure. This type of excision is a blind method which

* Read before the Staff Clinical Conference, May 19, 1942, Station Hospital, Fort Bragg, N. C.

sacrifices a great deal of surrounding normal tissue. Likewise because of the rigorously predetermined elliptical type of incision, cyst wall and infected scar which may extend laterally or down to the anal wall, may be transected and left in the depths of the wound. Not only may there be a large percentage of recurrences but also absence of healing.

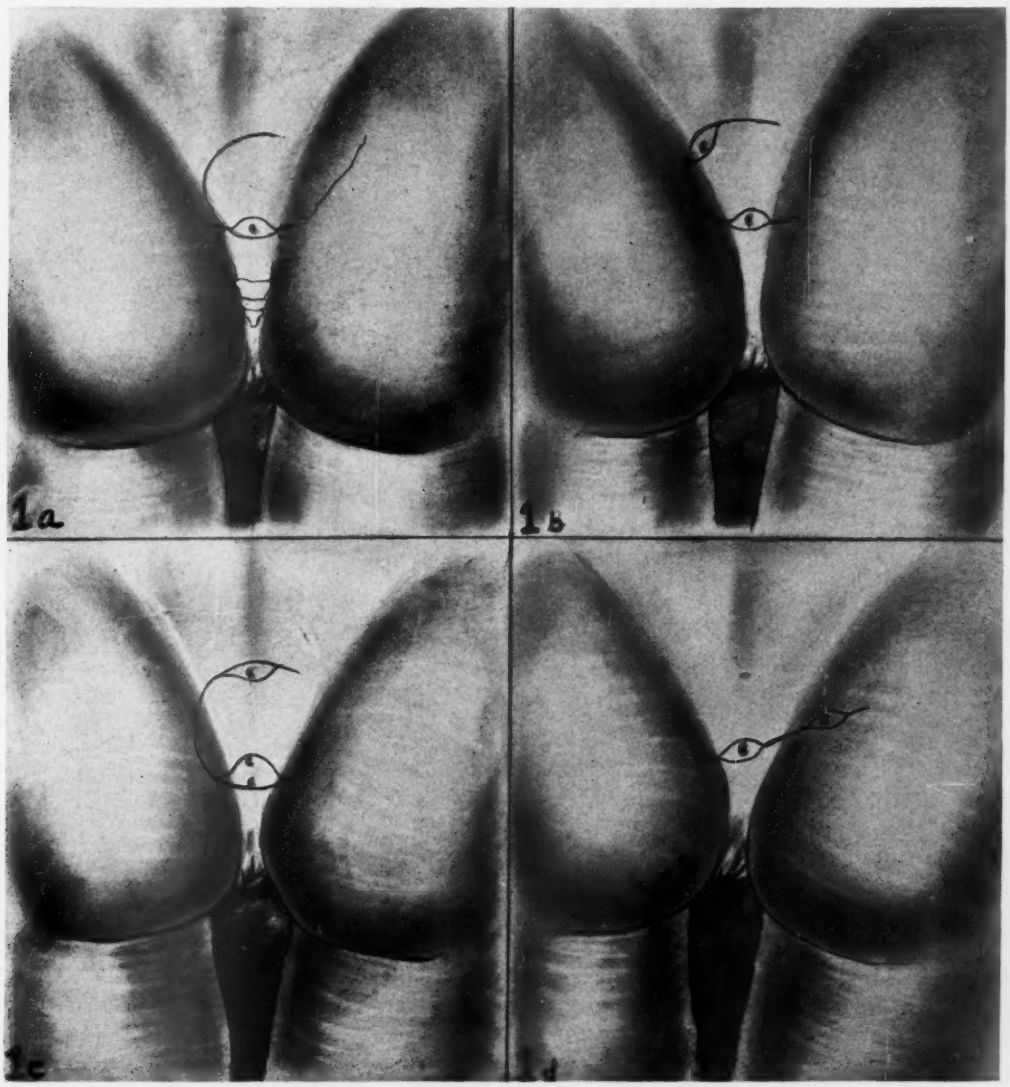

Fig. 1. *a, b, c, d,* the relative positions and arrangement of the sinus openings are portrayed. The heavy black line indicates the line of incision and outlines the skin islands left surrounding the sinus openings.

The Incision. Because healing and epithelization, owing to tension and maceration, are so often prolonged in the midline, the primary precept for the incision is that just as little of it as possible shall be in, or shall cross the midline crease. For this reason there can be no standard incision. Often because of the number and the arrangement of the sinus openings the ingenuity of the surgeon is taxed. One can always depend on a midline sinus opening. However, additional sinus openings which we shall designate henceforth as accessory sinus openings may be present either in the midline or to one side of it. The midline sinuses may be close together, two or three in number, or they may be spread apart. Accessory openings lateral to the midline are usually found in the skin over the left

buttock. These are the result of an extension of the infection when midline openings have become obliterated through one

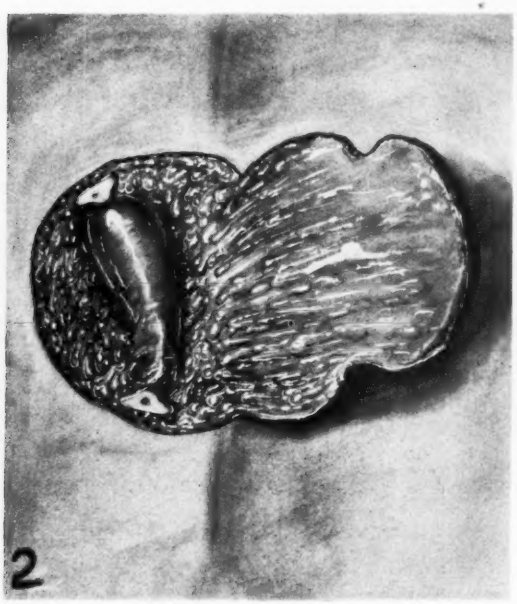

FIG. 2. The pedicled flap is reflected and the cyst is exposed. The skin islands surround the sinus openings and are dissected out attached to the cyst.

means or another. However, the accessory sinus may be present anywhere within a radius up to 1½ inches from the original midline opening. The original midline opening is usually found at the level of the sacrococcygeal joint. (Fig. 1, *a*, *b*, *c*, and *d*.)

At the operating table all sinus openings are carefully probed and the direction in which the probe passes is noted. This is very important since it alone determines the type and direction of the incision. A mixture of methylene blue and hydrogen peroxide is injected into any of the patent openings in order to stain the tracts for recognition during dissection. In the course of the study it became apparent that one type of incision was more frequently adaptable and efficacious than others. (Fig. 1, *a*, *b* and *c*.) This type begins and ends on the same side of the midline and is U-shaped. It circumscribes small elliptical pieces of skin which are left about the sinus openings. Minor variations are necessary depending upon the circumstances but this type of incision permits the reflection of a pedicled skin flap. After reflection, the exposure afforded is good not only for tracts running longitudinally in the midline but also for those which have sacculations to one side, or which may extend down and attach to the anal wall. The pedicled flap likewise saves the original thick skin for closure.

A second type of incision is usually transverse or oblique and is adaptable for sinuses or sacs which have accessory sinus openings to either side of the midline more or less at the same level of the original midline sinus opening. Elliptical pieces of skin are likewise left about the sinus openings when this type of incision is utilized. Here, however, instead of a pedicled flap the skin edges are undercut from ¼ to ½ inches on both sides, and turned back. This usually affords sufficient exposure and permits easier dissection. (Fig. 1*d*.)

The Dissection. When the U-shaped incision is employed the skin edges which form the border of the skin flap are grasped in Allis forceps and tension upward is applied. Dissection to reflect the flap is started at the immediate junction of skin and subjacent subcutaneous tissue. The flap is then carefully undercut. Often the cyst wall is immediately underneath the skin and the surgeon must cut close to or even split skin in order to avoid entering the sac. Methylene blue aids materially in defining the boundaries but even without stains the wall stands out sharply as a smooth opaque shiny structure. If the sac is entered, any cyst wall tissue left on the undersurface of the flap must be excised. After reflecting the flap and undercutting the opposite skin edge for ¼ inch the excision of the cyst is begun. (Fig. 2.) When the transverse or oblique incision is used, the skin edges are undercut for ¼ to ½ inch in the same manner as the flap. In either case a probe is inserted into the sinus opening into which it passes most easily and kept in place until the dissection has begun. The end of the probe denotes the lateral and upper margin of the cyst wall and indicates where separation from

the normal tissue should begin. The most cephalad skin island around the sinus opening is grasped in an Allis forcep, tension upward is applied and the tissue at the lateral margin of the cyst wall is incised and the wall thus partially freed. A plane of cleavage is defined very shortly; steady tension applied to the sac makes the fibrous bands attached to the cyst wall stand out sharply. These bands are transected. The sac may be further separated by inserting a Mayo scissors laterally and spreading the blades. Where the sac wall is particularly thick, blunt separation with gauze over the forefinger very often materially aids in removal by shelling out the sac in the correct plane of cleavage.

Although the sac or sinus usually originates as a midline structure, its eventual outlines have been found to be quite diverse. We have found prolongations into the fatty tissue above the gluteal muscles. Likewise large sac-like prolongations have been found to extend downward onto the anal wall and to be subjacent to the skin lateral to the anal opening. The depth of the sac is also extremely variable. It may be entirely superficial and following its removal only a small midline defect will be left in the subcutaneous fat. In other instances it may run downward and part of the cyst wall will be adjacent to the sacrococcygeal ligament.

It would appear entirely logical then that block excision using a set elliptical incision is the type of operation in which abnormal tissue more likely would be transected and left in the wound. On the other hand, by tracing the sac boundaries, by what we term anatomical dissection, the chances of removal of the entire sac and infected scar tissue would appear to be increased infinitely. As an instance in which this is graphically portrayed, we overlooked a small midline sinus opening hardly larger than a normal skin pore. The U-shaped incision was used in this case and while the skin flap was being reflected a small gelatinous sinus tract about 2 mm. in diameter was found leading into the above mentioned sinus opening. Recognition meant effective excision. It goes without saying that in order to accomplish a well planned anatomical dissection extreme care must be paid to hemostasis. Visualization of the field is imperative at all times.

HEALING

Closure. Our cases fall into two classes: those which could be closed entirely and those in which only partial closure could be accomplished. There has been a diversity of opinion concerning any closure. The chief objection has been that the area is always potentially infected, and as such one invites actual postoperative infection by closure. Complete closure with primary healing is the most ideal procedure following removal. We have combatted effectively the inclusion of potential infection by the use of a sulfathiazole-cod-liver-oil ointment. We have used this ointment in the wounds of severe hand-space infections, in the musculature and skin following thoracotomy for empyema and in the muscular layers following drainage of a perinephric abscess in which the layers were sutured. Infection cleared and healing occurred in a most dramatic manner.

The ointment is composed of sulfathiazole powder 10 per cent, cod liver oil 10 per cent in a lanolin base.

When this study was planned originally the procedure outlined was to close the skin flap partially and permit the wound to heal as the perineal wound following abdominal perineal resection of the rectum. Packing permeated with the ointment was placed underneath the flap. Postoperative dressings revealed the wound to be extremely clean, without odor and a minimum of drainage. Aerobic and anaerobic cultures from the depths of the wound were taken and bacterial contamination was found to be either absent or the colonies at a minimum. In the case in which bacteria were present the morphology was so altered that the bacteria could not be identified and it was evident that severe

attenuation had occurred. Further bacteriologic study indicated that the ointment had bacteriostatic properties only

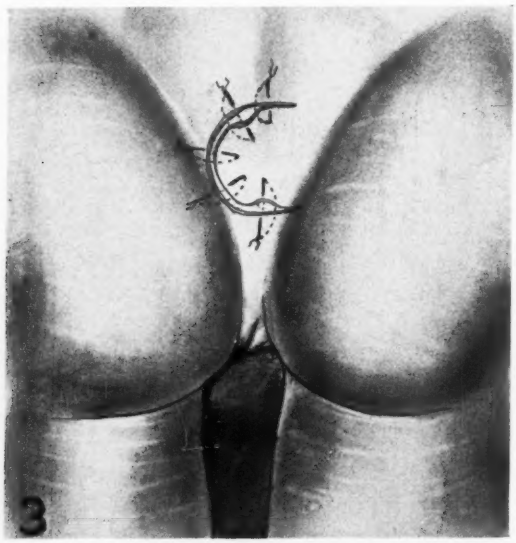

FIG. 3. The flap is replaced and silkworm Stewart sutures are placed ready for tying.

on interaction with the body tissues. Control studies with the ointment used in culture medium did not reveal any bacteriostatic properties at all. With the use of the ointment the logic for primary closure, complete or incomplete, became apparent.

Primary Closure. Most of the incisions may be closed completely. The type of excision does not sacrifice normal tissue and the subcutaneous structures usually may be brought together without tension. Plain No. 0 catgut sutures are used to close the defect. Suture bites about ½ inch in length are taken on either side and if the sacrococcygeal ligament has been exposed by dissection, the suture is drawn through this structure as a mattress stitch, affording additional anchorage. Experience has shown that all sutures should be placed before the ointment is instilled in the wound. A little careful planning will usually permit the tissues to be drawn together so that the opposing sides fit without tension. The ointment is then placed in the cavity and the sutures are tied. Closure squeezes out the excess ointment and during healing the remainder of the oily substance slowly leaks out after it has reached body temperature. The skin flap or skin edges as the case may be, is replaced and approximated with silkworm Stewart sutures. (Fig. 3.) Sometimes the flap must be revised in order to fit the opposite side. This may involve trimming away redundant skin or stretching skin edges slightly to fit in the upper and lower angles. Usually a slight midline depression into which the skin flap falls, takes up any redundancy bringing the edges into perfect approximation. Extreme care must be used in approximating the skin edges because postoperative motion may pull the flap so that one skin edge may override the other.

Partial Primary Closure. In cases in which the defect cannot be drawn together at all points without tension, part of the defect is left unsutured. We have had no case in which the angles of the defect cannot be approximated, so the eventual dead space is left in the center and is considerably smaller than the open granulating wound following block excision. The residual space is filled with the ointment and the skin flap reapplied as in the primary closure except for the suturing. Part of the skin is left open at one or the other side of the midline so that the ointment may escape as granulation occurs from the bottom and so that ointment may be inserted daily. The healing time has been decreased in these cases not only because of the decrease in the size of the defect, but also because the ointment has shown itself to be extremely stimulating to the growth of granulations and epithelium.

In two cases in the series the cyst wall extended down to the subcutaneous tissues to the right of the anus. These cases were primarily closed except for a ½ inch stab wound in the skin to the right of the anus into which a small rubber drain was placed. The excess ointment found egress from the depths of the wound through the stab opening and healing was by primary intention.

Pre- and Postoperative Care. These cases were all infected, some mildly some se-

verely. Preoperative drainage was encouraged if possible through the original sinus openings which were probed open. The patient received hot sitz baths several times daily until inflammation cleared; no specific time interval was allowed preoperatively. In most instances the sitz bath régime lasted only a few days.

An enema was given the night before operation. Preoperative medication was a grain and a half of seconal one hour before operation, morphine sulfate gr. ¼ and atropine gr. 1/150 one-half hour before.

At the operating table spinal novocain 100 mg. was used for anesthesia. The patient was placed on his stomach, the buttocks held apart by adhesive straps, stuck to the side of the operating table. The field was prepared by cleaning with ether and painting with tincture of merthiolate.

Following operation one ounce of mineral oil was given daily for four days. Bathroom privileges were permitted but the patient was otherwise restricted to bed for four to five days. Postoperative medication for pain was almost entirely unnecessary because of the soothing properties of the ointment. In the cases in which the incision had been completely closed, unless there was a temperature elevation, the first dressing was done on the seventh postoperative day at which time the sutures were removed and a sulfathiazole-cod-liver-oil ointment dressing reapplied. In the cases in which the incision had been left partially open the first dressing was done on the third postoperative day when more ointment was instilled in the dead space through the slitlike opening in the skin. We found the subsequent daily instillation of the ointment could be accomplished more effectively by injecting it through a metal ear syringe. Sutures were removed on the seventh postoperative day. In these latter cases it was found that granulation often heaped through the skin defect or that the skin edges turned down. Intervention was found unnecessary since nature revised the wounds in all cases. Granulation shrunk back into the wound and the skin edges were bridged over by smooth epithelial tissue.

RESULTS

In comparison with other methods the healing time following excision of pilonidal cysts by this method has been markedly reduced. The average healing time in thirty cases, including those of primary closure and of partial primary closure was twenty-six days. The range in healing time is from ten to forty-three days. Forty per cent of the series were healed and discharged from the hospital in from ten to twenty days; 30 per cent in from twenty to thirty days, and 30 per cent in from thirty to forty-three days.

In 50 per cent of the cases in which complete primary closure was effected, following removal of the sutures on the seventh postoperative day, the skin edges at the lower angle of the incision separated for ¼ to ½ inch. This always occurred where the incision crossed the midline which further substantiates the rationale for using an incision which does not necessitate as much midline healing as is necessary in the block excision. The particular stress exerted on the skin edges at this point is the same as that exerted on the granulation and epithelium throughout the entire course of the midline following the old types of excision. Retention of sutures for a longer period of time, or adhesive strapping which kept the buttocks from spreading, tended to avoid this separation. However, when sutures are retained for more than seven days they show a marked tendency to cut through the skin flap. When separation does occur, the small size of the midline aperture, its transverse position, and the fact that the ointment not only stimulates healing but also keeps the wound free of infection, make subsequent healing a matter of a short additional time. There was one case of gross wound infection in a patient who developed generalized furunculosis two days after operation. The wound in this case was opened widely and packed with the oint-

ment daily. Healing occurred in thirty-six days.

The healed wounds have remained solidly healed following discharge from the hospital. There has been no instance in which splitting of the incision has occurred; there has been no superficial maceration, no abscess formation and no tenderness or pain. Sufficient time has not elapsed so that an evaluation of end results can be made, although immediate results have proved to be very good. In a second series of cases which we have started the results appear even more promising.

SUMMARY

1. A new type of operation and treatment for excision of pilonidal cyst is presented. We argue that the chances for complete removal of cyst and infected tissue are increased by an "anatomical dissection."

2. A new type of incision avoids the midline except where it crosses it in the transverse direction.

3. The method used retains original skin, sacrifices little normal tissue and the defect is closed partially or completely.

4. Healing is stimulated and the possibility for infection is reduced by instilling a sulfathiazole-cod-liver-oil-lanolin ointment in the wound previous to closure. This substance is also used for subsequent dressings.

5. Healing time is markedly reduced by decreasing the necessity for granulation and by retention of original skin.

6. Immediate results indicate a solidly healed wound and absence of complications attendant upon midline healing.

REFERENCES

1. Kooistra, H. P. Pilonidal sinuses. *Am. J. Surg.*, *55*: 3–17, 1942.
2. Rogers, H. and Dwight, R. W. Pilonidal sinus. *Ann. Surg.*, 107: 400–418, 1938.

SKELETAL FIXATION OF FRACTURES

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SINCE the origin of man, broken bones have been one of his major problems. Recent facts brought to light show that the early Egyptians practised the treatment of fractures by internal and external fixation. More or less crude applications of these principles were used until the seventeenth and eighteenth centuries. It is from this period that the evolution of our modern concepts of rational treatment began. The early bone setters reached their zenith with Hugh Owen Thomas in the latter part of the nineteenth century.

At this time treatment of fractures by fixation and rest was generally accepted, and there were in vogue several procedures to achieve this end. The French school made use of the plaster of Paris cast and splint, while another large group of contemporaries subscribed to the principle of fixation by extension as advocated by Davis, Sayre and Taylor of New York. Still a third large group, the disciples of Hugh Owen Thomas, invariably practised the doctrine of "enforced, uninterrupted and prolonged rest." Thomas early in his career recognized the disadvantages of plaster casts. He devised an instrument to produce fixation and rest without constriction. This instrument known as the Thomas splint is widely used today. The fact that limited and controlled motion at the site of fracture produced excess callous formation was recognized early by Thomas and led him to the practice of percussion, at frequent intervals, over the site of fracture.

At the time of Lucas-Championniere, treatment by immobilization was considered of prime importance. Lucas-Championniere swung the pendulum in the opposite direction and convinced many that motion was of prime importance in the treatment of fractures. Thirty years later the medical profession came to the conclusion that had been arrived at over one hundred years before by Jean Pierre David who said that "rest and motion had respective and equally important places in the rational treatment of fractures."

Kellogg Speed[1] in his textbook says the following:

"The development of the distraction of nail extension is interesting. In 1903 Codivilla first applied a cast to a fractured leg from the toe to the pelvis. The next day he cut the cast circularly, dividing it about the middle of the thigh. By means of strong traction the severed surfaces of the cast were separated, and the space created was filled in with fresh plaster of paris, traction being maintained until setting. This procedure could be repeated. The method was abandoned because decubitus sores developed about the tuber ischii and dorsum of foot.

"To avoid these pressure ulcers Codivilla left the foot and ankle free and put two lateral irons into the lower end of the cast. The free ends of the iron ran down beside the ankle and were fitted by means of holes over a nail driven through the os calcis. Pads were applied over the ischium and decubitus was avoided.

"Steinman, in 1907, discarded the cast altogether and applied traction directly to the nail ends passing through the os calcis.

"In Von Eiselberg's Clinic in 1901 Kafer, in putting a cast on a leg, incorporated a turnbuckle on either side. The cast was cut and the halves distracted by turning up the turnbuckles.

"Hackenbruch[2] improved this method by putting a ball and socket joint at either end of the turnbuckle where it joined onto the

embedded plate. By distraction, shortening in the leg was overcome inside of forty-eight hours; then the four ball-and-socket

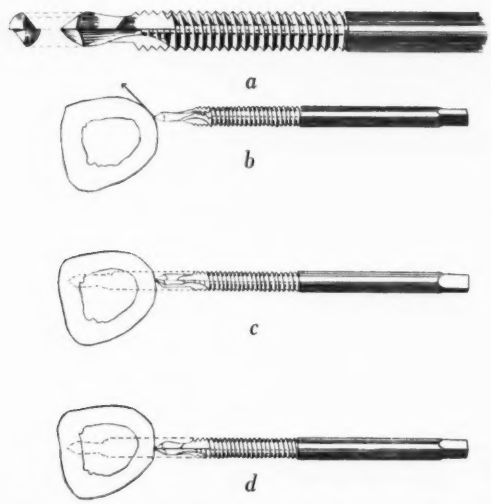

FIG. 1. *a*, combination drilling and self tapping half pin. *b*, poor site of insertion, outer one third of diameter of bone; *c*, fair site of insertion; *d*, preferable site of insertion.

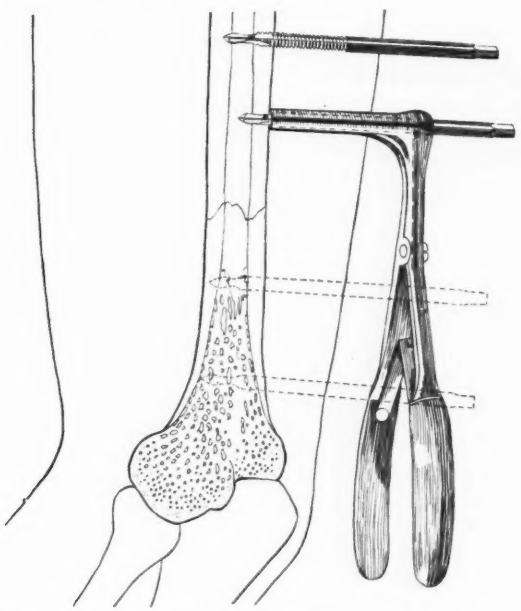

FIG. 2. To prevent soft tissue trauma, the bivalved sleeve is placed around the pin, worked down to the bone surface and held there while the pin is inserted into the cortex.

joints were cautiously loosened, and any lateral displacement was corrected.

"The reduction was checked by roentgenograms, and when a satisfactory adjustment was reached all points were firmly fastened and the patient was allowed to walk on the leg, thus held in perfect position. Patterson's method[3] is the same. Gerster[4] has adopted Steinman's nail extension as a part of a splint for maintaining extension during transportation. To avoid the pressure on the ischium he used an upper padded ring made in two halves hinged behind and locking in front.

"The splint was composed of long bars of hard wood, which do not interfere with roentgenograms, and the lower end was formed by a stirrup, with slotted bars permitting adjustment by thumb-screws. Tongs were applied to the nail, and a cross bar held them up, while a rope attached them to the distal end of the splint."

Arbuthnot Lane, in 1894, developed internal fixation of fractures by the use of metallic bone plates. F. H. Albee, in 1911, first introduced autogenous bone grafts for internal fixation.

The basis of the modern rational approach to the treatment of fractures is that of anatomical reduction. Anatomical reduction means the restoration of the normal axis of the extremity by proper alignment, with consequent protection of joint movement from abnormal strain and the preservation of unaltered lines of contraction for the adjacent muscles.

The idea of skeletal fixation was conceived by the author while working with the late Colonel Joseph Blake at Red Cross Hospital No. 2, at Paris, in 1918. Not being able to work out a satisfactory connection with sufficient flexibility and strength, nothing was done until 1932, when a practical bar was made up.

From this date it took five years to interest any surgical instrument manufacturer sufficiently to produce the splint. Early in 1938, the first splints were made, none of which were applied until June, 1938.*

Doctor Harold R. Conn,[5] of Akron, Ohio, produced a splint which he reported. This has two pins in each fragment which

* Manufactured originally by the Zimmer Mfg. Co., Warsaw, Indiana.

come through the skin and has an adjustable metal support. This is much lighter and much less flexible than the splint we are describing.

of Philadelphia, developed a splint very similar in principle which he uses in the veterinary field.

The method of treatment of fractures

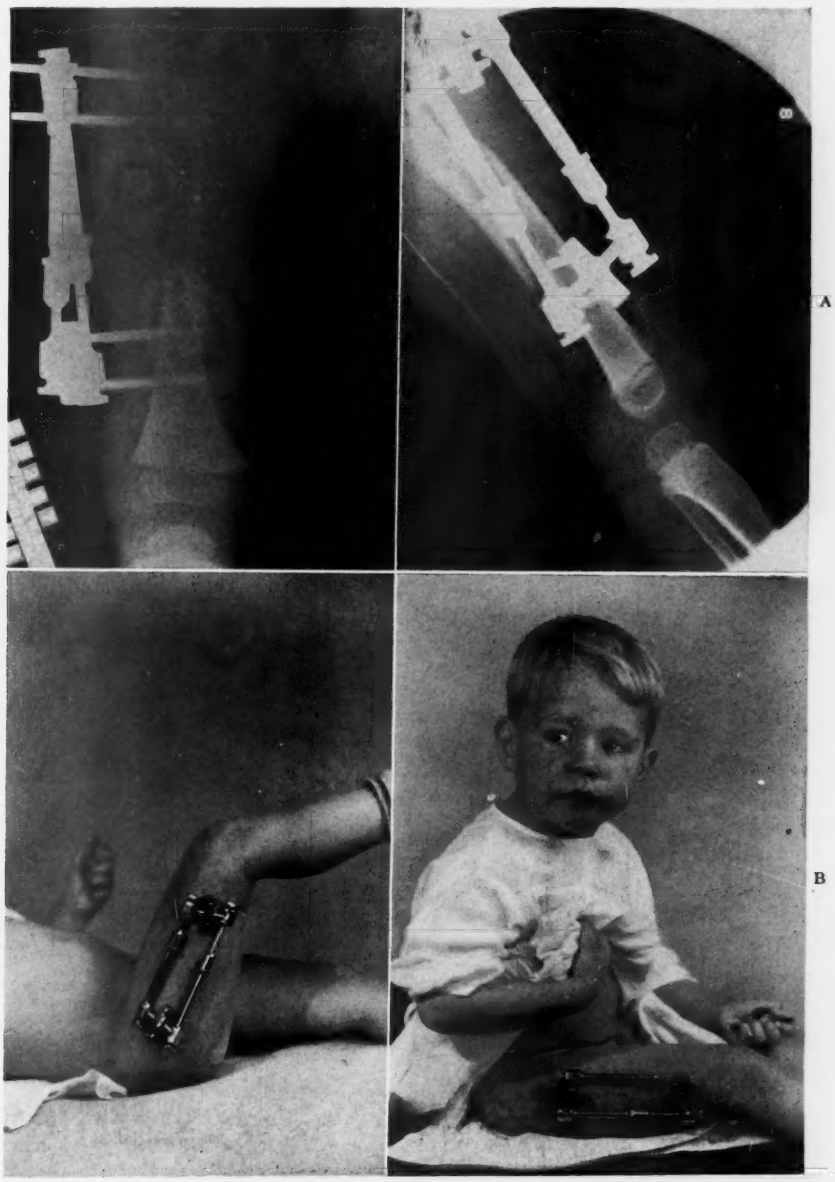

Fig. 3. A, anteroposterior and lateral *x*-ray plates (splint applied). B, showing radius splint applied to the baby's thigh and the amount of freedom of mobility of joints.

Doctor Rogers Anderson[6] uses skeletal fixation with his reduction apparatus, supported by plaster cast which he also reported in 1938. Doctor Anderson has since designed and is now using a skeletal fixation apparatus with a metal support.

Doctor Otto Stader, veterinary surgeon,

described in this paper achieves anatomical reduction by the use of an instrument combining the principles of internal and external fixation without the necessity of open operation. Fixation is limited to the individual segment except in those cases in which the line of fracture is closely adjacent

to or invades the joint proper. With this instrument fixation of the highest degree is obtained for the individual segment and the important motion of the entire member is preserved.

This method of treating fractures is in the early developmental stage and is necessarily crude. Time and experience are certain to bring great improvement.

In describing a new method of treating fractures, in which so many principles are involved, it is difficult to convey an accurate picture of the process either with words or illustrations. The size and shape of the splints vary markedly according to size, shape and function of the bone or bones involved. However, the same principle of skeletal fixation of the individual bone holds good throughout. The principle underlying this method of treatment is to anchor a strong pier to each distal fragment and bridge the fracture or fractures with a fabricated steel network. In this manner the distal ends of the bone are maintained

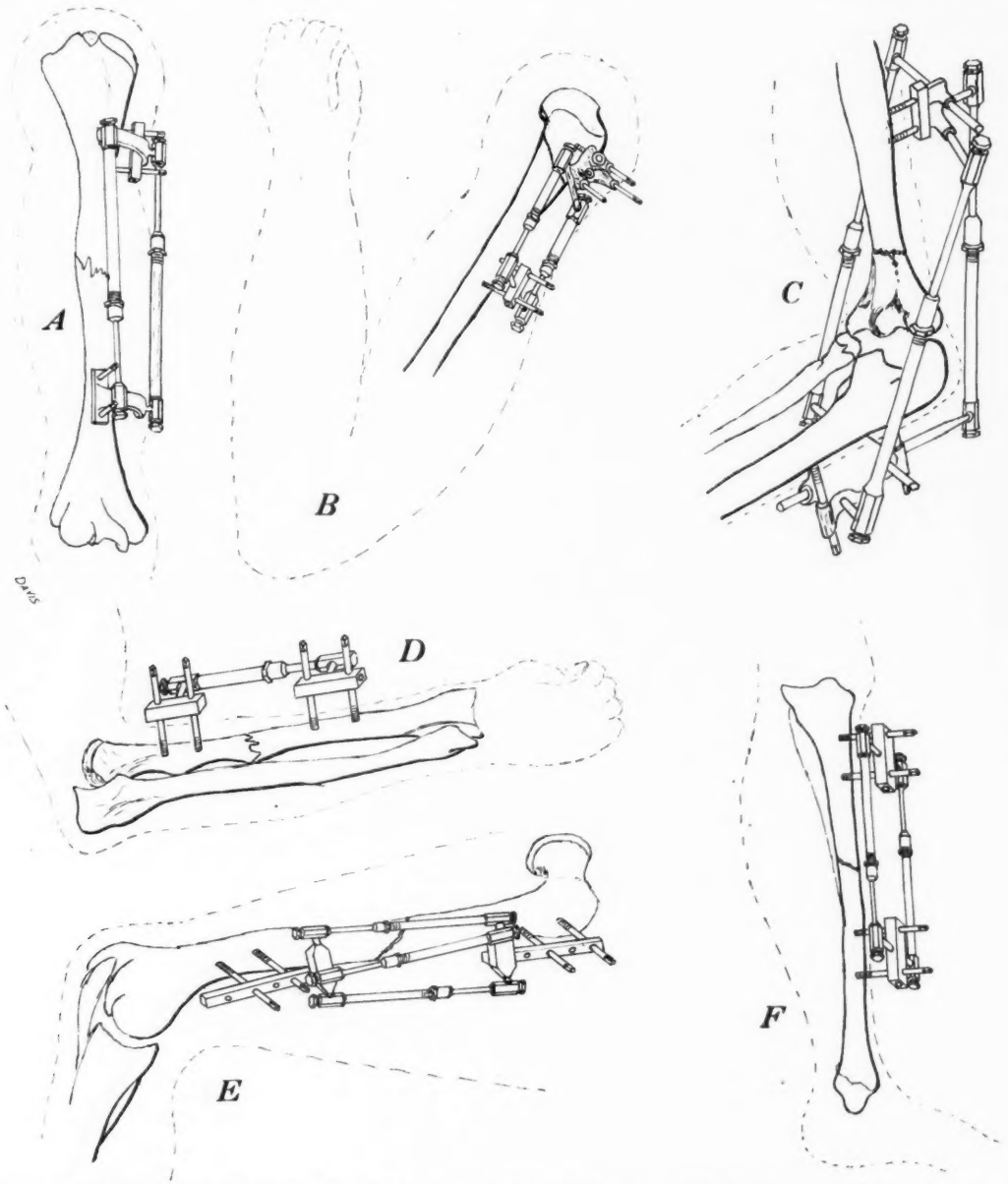

Fig. 4. Schematic drawing of splints for fractures of surgical neck, shaft and lower end of humerus, radius, tibia and fibula.

in definite relation to each other, which enables them to function as they did before the fracture. This principle is carried out in fractures of all the long bones except in those instances in which, either on account of lack of distance or comminution, adequate application of the anchoring pier cannot be made.

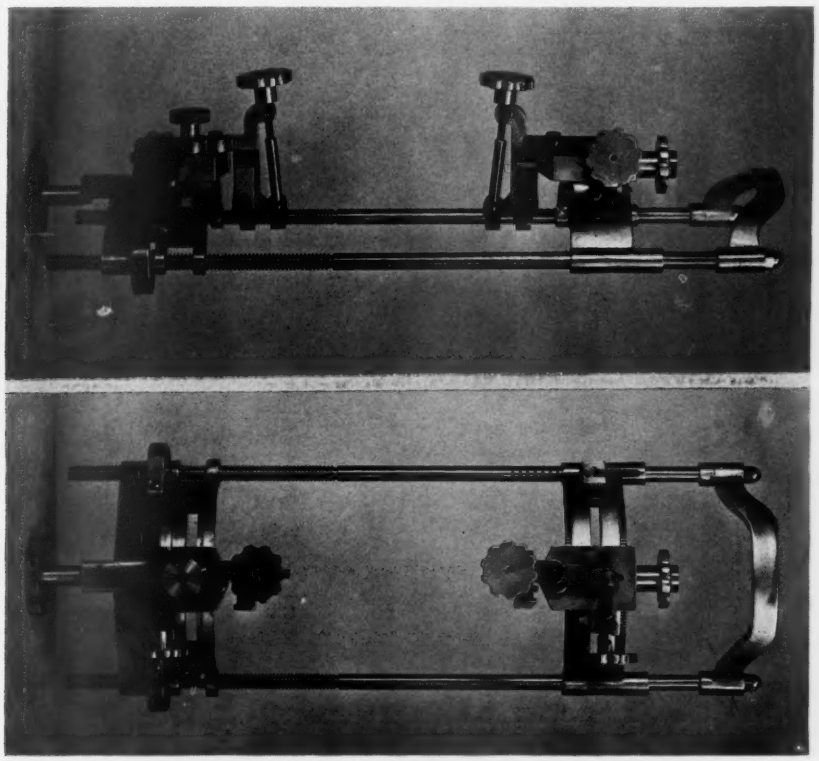

Fig. 5. Top and side views of reduction apparatus. Extension apparatus has triple-compounded leverage for the extension and motion in three planes, all controlled by gears in order to prevent slipping, jerking or losing apposition. After satisfactory reduction is made, the bars are applied and the reduction apparatus is removed.

Skeletal fixation of joints is made use of in the following conditions: intra-articular fractures in which motion of the joint is undesirable, and fractures in which the distance is inadequate or the comminution too great for proper application of the anchoring pier. Under these conditions, a modified appliance is used to bridge and fix the joint, but the underlying principle is the same as that used in fixation of the individual bone.

The appliance is composed of three functional units: They are the two, or more, attaching pins and the intermediate, stress-bearing connecting unit, which together compose the anchoring pier and the fabricated bridging device. (Fig. 4.)

Solid attachment to the bone is secured by the use of either threaded half pins or through-and-through pins. (Figs. 1 and 2.) The half pins are made of stainless steel, with a cutting point, deep threads and a head for adaptation to a chuck wrench or brace. The half pins vary in length from one inch to four and one-half inches, and in diameter from three to seven thirty-seconds of an inch. The through-and-through pins are the usual type of Steinman pins.

The stainless steel blocks are composed of rectangular bars of varying sizes, containing multiple holes which accurately fit the threaded half pins they are made to accommodate. The pins are secured in the block by set screws. The bridging device is firmly attached to the blocks by means of

the multiple spheres, which are connected to the blocks by slender shanks. The appliance is demonstrated in Figure 4.

bars with a split sleeve adjustment. On each end of the telescoping bar is a friction clamp with a universal joint for

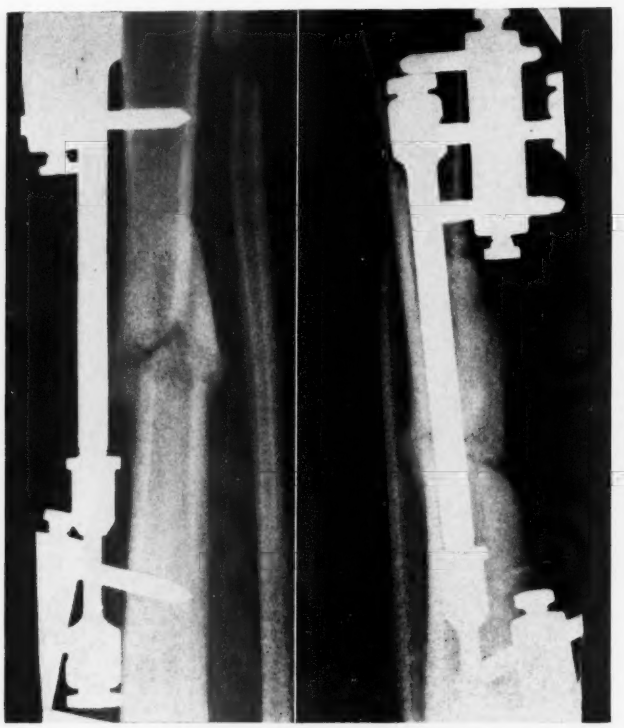

FIG. 6. Pins in place eleven months in comminuted fracture of the tibia and fracture of the lower end of the fibula. "The alignment is very satisfactory. There is evidence of considerable new bone formation at the site of the fracture of the tibia, but none is seen in the region of the fracture of the fibula. The most interesting finding is the lack of bone absorption around the screws in the traction device. Minimal absorption is noted around only one of the three visible screws. No bone absorption is observed around either of the others. This is unusual after an interval of eleven months." (Comment by Whitmer B. Firor, M. D., Baltimore, Md.)

When the through-and-through pins are used, it is necessary to grasp firmly both ends of both pins. This is readily accomplished by a yoke. The attachment of the yoke to the pins is accomplished by collars, built in the yokes. These collars grasp the ends of the pins and are in turn secured by set screws. The collar attachment of one pin of each pair of pins is flexibly adjustable to facilitate application of the yoke. Multiple spheres mounted on slender shanks attached to the yoke provide for connecting the bridging device.

Fixation is accomplished by a fabricated bridging device composed of telescoping grasping the spheres mounted on the block or yoke.

In the experience of the author this treatment has been quite satisfactory in the following cases: simple or compound fractures of the long bones and mandible; as a substitute for bone plating; as a support in the after-treatment of bone grafting and correction of angulation and malposition. Judging from my military and subsequent experience in traumatic surgery, and the report of Dr. Phillip D. Wilson and W. R. Ferguson, of the American Hospital in Britain, skeletal fixation will prove to be of inestimable value in military surgery.

This treatment is not recommended in Colles' fractures because the standard procedure is so satisfactory. Often there is not sufficient room for attachment to the distal fragment. Neither is the treatment advised in simple fractures which are easily reduced with little or no tendency to disapposition or deformity, nor in green-stick fractures.

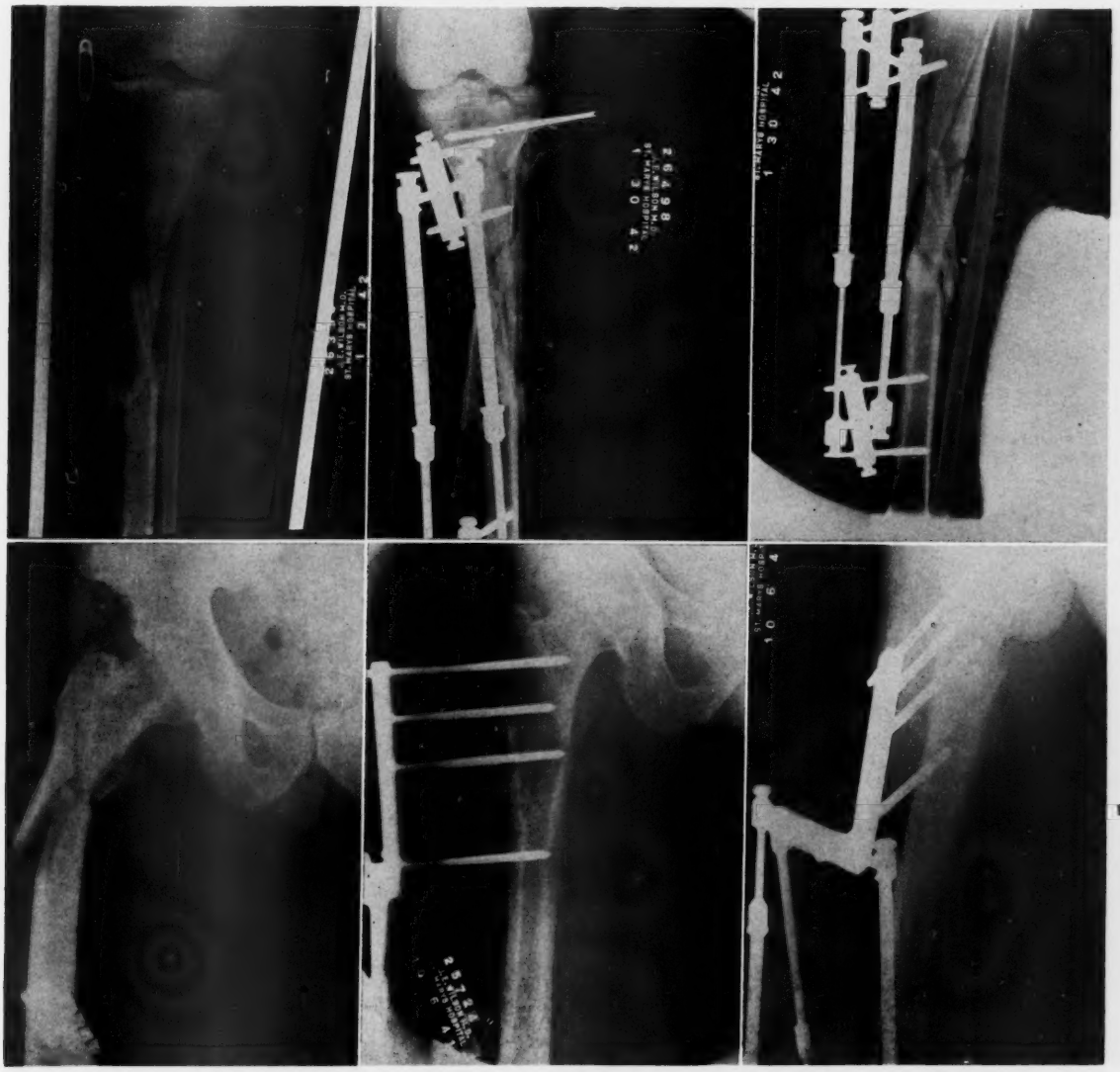

Fig. 7. Fracture of tibia involving the joint. A, anteroposterior and lateral views after reduction. Fixation pin nearest the knee joint is separate from the splint. B, fracture of upper end of femur involving trochanters. Anteroposterior and lateral views after application of splint.

Foremost among the advantages this treatment has to offer is motion of all joints proximal and distal to the fracture. Pain is almost negligible as soon as the fracture is reduced and the splint locked. In simple fractures the skin can receive much better attention and massage can be started immediately. In compound fractures the wound can be more adequately cared for and dressed. If desired the Carrel-Dakin treatment can be conveniently carried out. The patient is immediately ambulatory unless more than one limb is involved. Osteoporosis is surprisingly less, due to the use of muscles and joints causing better circulation of blood and lymph. The fact that the pins are used for fixation apparently causes less damage to the bone than when they are used for constant trac-

tion. This conclusion is arrived at from clinical experience and *x*-ray examination.

Two outstanding cases are here reported, with photographs of *x*-ray plates and the report by Doctor Firor of the *x*-ray findings. (Fig. 6.) The first is of bilateral compound, comminuted fracture of tibia and fibula in a twenty-seven-year old white female, in which the pins remained eleven months. These wounds were grossly infected before the patient was sent to the hospital twenty-four hours after her injury.

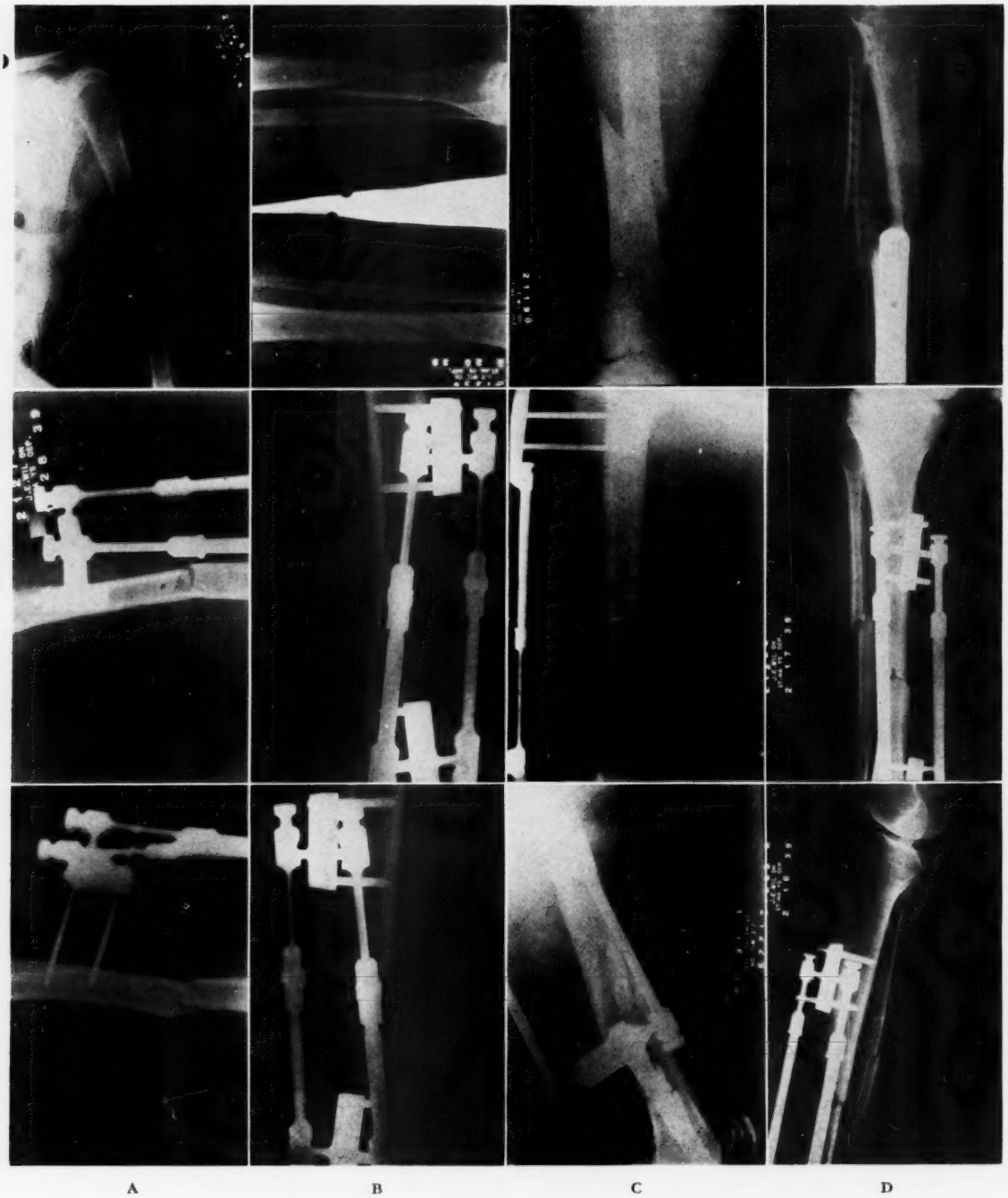

Fig. 8. A, fracture of shaft of the humerus; lateral and anteroposterior views. B, comminuted fracture of tibia and fibula; anteroposterior and lateral views. C, comminuted fracture of the femur; anteroposterior and lateral views. D, transverse fracture of tibia and fibula with loss of bone substance; anteroposterior and lateral views after splint application.

In the second case the pins remained *in situ* nine months.

Patients may alter their position in bed without help. Consequently, less nursing is required and inspection and mensuration is greatly simplified. The periods of hospitalization and disability are both very materially shortened and ordinary clothing can be worn over the splints. After the first few days it is exceptional to see any swelling of the limb, unless the fracture is compound and there is extensive soft tissue damage.

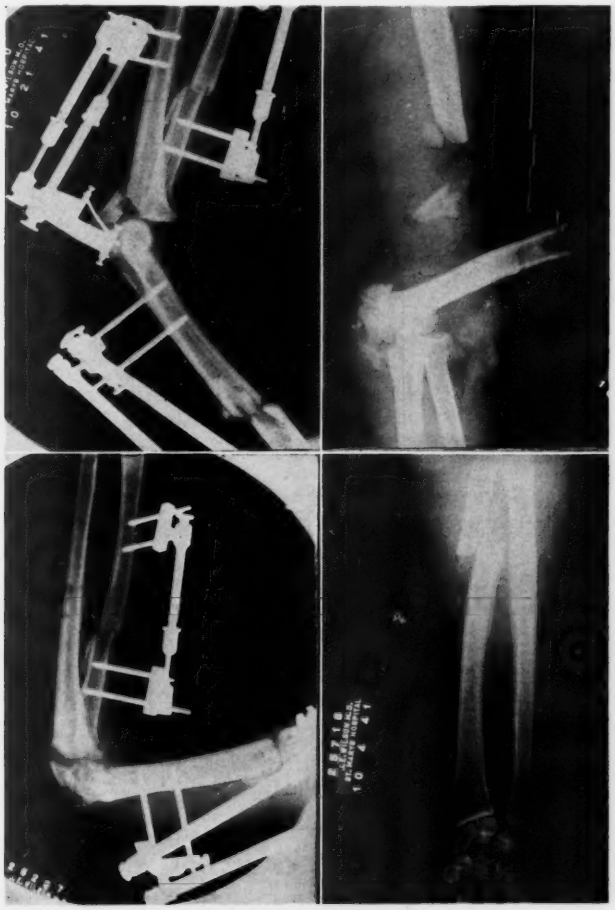

Fig. 9. Car door injury with very extensive damage to soft tissues. Three splints applied: one to humerus, one to radius and one to olecranon.

Splints have been designed for fractures in ten body areas as follows:

1. Humerus—surgical neck
2. Humerus—shaft
3. Humerus—lower third or fractures about elbow
4. Forearm—radius or ulna
5. Femur—shaft
6. Femur—lower third or fractures about knee
7. Tibia—shaft
8. Patella
9. Olecranon
10. Mandible

Since the application of the instrument requires the most rigid aseptic conditions and technic, the procedure lends itself only to hospital and operating room practice and should never be attempted in the office or home. With modern transportation facilities and temporary splinting, any fracture requiring skeletal fixation can be hospitalized.

Points in the technic common to the application of all types of splints are as follows: Careful roentgenographic studies

should disclose the position of the displaced members as well as the type and site of the fracture. From the roentgenogram the type of appliance required as well as the approximate length of the bone pins needed can be ascertained.

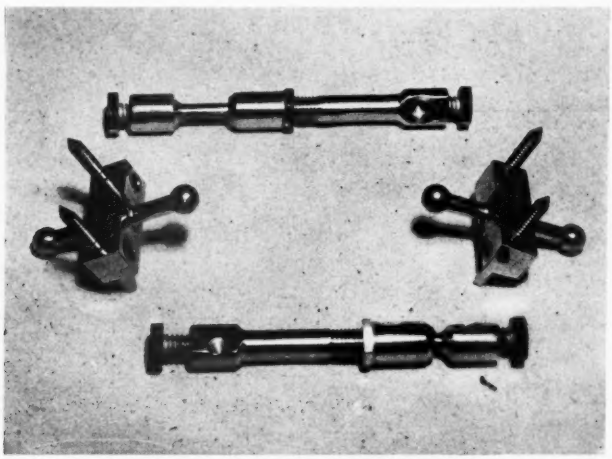

Fig. 10. Disarticulated radius splint with two bars. This is the simplest splint but the principle of all is the same, being two anchoring piers with connecting bars.

Anesthesia. The application can be carried out under local anesthesia, but in most instances a choice of intravenous or a short acting general anesthesia is to be preferred. For fractures of the lower limb small doses of a spinal anesthetic agent are preferable.

Preparation. The skin is prepared by shaving, after which it is scrubbed with green soap and water, followed by a sterile bichloride of mercury solution. This is followed by scrubbing with ether, alcohol and then the application of iodine or any of the accepted skin disinfectants.

When using half pins the site for attaching the block to the proximal fragment is then selected. It is important to place the soft tissues at rest, as nearly as possible in their normal position, before the pins are introduced. The block should be well away from the line of fracture. A stab incision 1 cm. long is made through the skin overlying the bone. Through this incision the threaded half pin is introduced down to the bone and after finding the approximate midpoint, the pin is started into the bone. If the pin is placed on the outer part of the diameter of the bone it will slip off instead of starting. (Fig. 1.) To prevent soft tissue trauma the bivalved sleeve is placed around the pin and worked down to the bone surface and held there while the pin is inserted into the cortex. The sleeve is removed and the pin screwed on across the medullary canal. An increased resistance is noticed when the opposite side of the cortex is reached after which the point is firmly seated in the cortex, by taking two to four additional turns depending on the size of the bone.

The protruding head of the pin is inserted in the proper hole in the block, and the pin and block are used as a guide to find the proper site for insertion of the second pin. This second pin is then introduced through a stab wound in the skin in a similar manner as described above, except that the hole through the block serves as a guide. The technic of insertion of the pins and attaching the block to the distal fragment is a repetition of the above procedure.

The blocks are secured to the inserted pins by tightening the set screws in the sides of the block. A light alcohol dressing is then applied about the pins and blocks.

By manipulation and traction, preferably under the fluroscope, the displacement is corrected. With the fragments held

in place by an assistant, or by the reduction apparatus described below, the bars are secured to the blocks and the friction clamps in the ends of the bars are tightened on the spheres attached to the block. The split sleeve locks in the middle of the bars are then tightened, thus fixing the fractured bone and maintaining position by skeletal fixation.

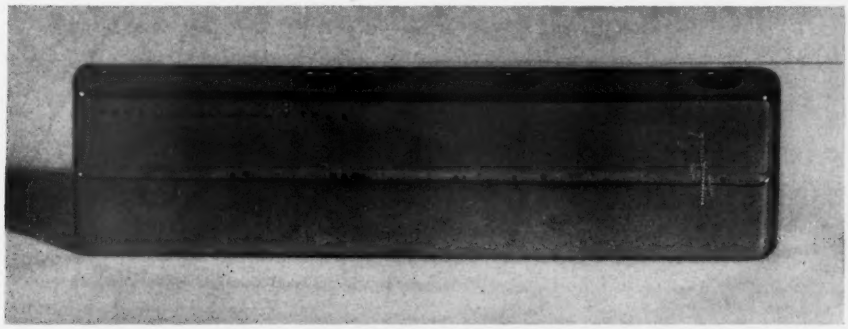

Fig. 11. Bennett block suggested by Dr. George E. Bennett. To be used as a guide for introducing pins. After dressings are applied to protect the wounds, blocks and bars may be applied without the necessity of sterilization.

It is always difficult to manipulate a very muscular limb, even with clamps on the block. For this reason a reduction apparatus has very recently been designed which attaches to the blocks. With this it is possible to get motion in three planes, plus extension. Motion in each plane is obtained by a worm gear which maintains fixation of fragments in any position. The bars are then applied, maintaining any desired position permanently. (Fig. 5.)

In those instances in which it is preferable to use yokes and through-and-through pins, the application is simplified, especially if any one of a number of standard guides is used. As pointed out by Rogers Anderson,[6] it is important that the pins are not placed parallel to each other. After the pins are introduced, both ends of both pins are attached to the yoke and securely locked in the collars. The yokes and pins by their firm attachment to the bone can be used to aid very materially in manipulation and extension. After reduction, fixation is accomplished by application of the bars to the yokes in the above described manner.

When a yoke is applied to one fragment and a block to the other, it is necessary to modify the block. This is done by using a crescentic support on which are mounted multiple spheres. The support is attached to the block by a universal friction joint. When the bridging device firmly connects the yoke and the crescentic support, the block and yoke are held in definite relation to each other.

No appreciable amount of slipping has been noticed in any instance in which two or more pins have been securely anchored in each pier. In a few cases of extremely severe injuries, with extensive loss of both bone and soft tissues, pins have been anchored near the joints in a thin spicule not covered by skin. These held about twenty days until they began to show evidence of loosening.

The splint can be removed with very little pain, making the use of an anesthetic unnecessary. First, the hexagonal ends of the connecting bars are grasped to maintain stability. Then the connecting bars are removed, after which a fair estimate of the amount of union can be determined by manipulation of the yokes or blocks. If union is sufficient, the blocks or yokes are disconnected from the pins. At this point the wound and pins should be very carefully cleansed with alcohol and painted with a dependable antiseptic. When through-and-through pins have been used, the end of the pin, which is intended to be drawn through the limb, should be

meticulously cleansed and removed by the ordinary method of removing Steinman pins. After the pins have been removed, an ordinary piston syringe is used to force 70 per cent alcohol through the wound.

The half pins are removed simply by unscrewing them with a tap wrench. When the pins have been started they will turn out with little resistance. After the pins are removed a cannula is passed to the bottom of the tract left by removal of the pin. Seventy per cent alcohol is injected to flush out the tract from the bottom. The skin surfaces of the pin wounds are again cleansed after which dry dressings are applied.

The intention of this article is to show the underlying principles and mechanics of skeletal fixation and demonstrate that the pins hold with a minimum of bone absorption. Case histories have been omitted because they have little if any bearing on the subject.

It should be clearly understood that anyone who attempts to use this method of treating fractures, who is not familiar with the principles of bone and joint surgery, and has not a thorough knowledge of anatomy, is inviting disaster.*

REFERENCES

1. Speed, Kellogg. Fractures and Dislocations. Philadelphia, 1916. Lea & Febiger.
2. Hackenbruch. *Ztschr. f. Arztl.*, p. 28, 1913; *Zentralbl. f. Chir.*, p. 605, 1913; *Deutsche Ztschr. f. Chir.*, 122: 464.
3. Patterson. *Am. J. Orth. Surg.*, p. 649, 1913.
4. Gerster. *Am. J. Surg.*, 28, No. 31; *Am. J. Med. Sc.*, 146: 157, 1913.
5. Conn, Harold R. Internal fixation of fractures. *J. Bone & Joint Surg.*, 13: 261, 1931.
6. Anderson, Rogers. *Am. J. Surg.*, 39: 538, 1938.

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COMMINUTED FRACTURES AND FRACTURE DISLOCATIONS OF THE BODY OF THE ASTRAGALUS

OPERATIVE TREATMENT

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CRUSHING fractures of the astragalar body, as well as fracture dislocations of the body of this bone, are in practically all instances followed by severe disability. Although most surgeons, according to reports in the literature, are of the opinion that these fractures are best managed by operative measures, there is no unanimity of thought with regard to the type of operative procedure.

My interest in fractures of this type was increased when a sixty-year old man, who had sustained a fracture dislocation of the body of the astragalus, was referred to me for correction of the foot deformity which had followed removal of the fractured astragalar body. The neck and the head of the astragalus had not been disturbed. Because of his age, this patient was not a good subject for remedial surgery. Yet, it was my belief that his partial astragalectomy would ultimately produce a crippling disability. I, therefore, decided to ankylose the tibia to the undisturbed neck of the astragalus by means of a sliding graft from the anterior surface of the tibia. The result was excellent. Some time later I performed a similar operation on a man who had a severely comminuted fracture of the astragalar body. The result in the second case was as good as that in the first.

TECHNIC

The ankle joint is exposed by means of an anterolateral incision, which permits both the removal of the sliding tibial graft used in this operation and the embedding of the graft into the neck of the astragalus. Speed and Boyd,[12] as well as Campbell,[3] who have used the anterolateral incision for ankle fusions as well as for removal of sliding grafts from the anterior surface of the tibia, have already called attention to the wide exposure of the ankle joint which this incision affords. For the technic of the incision, I have drawn freely from the description contained in Campbell's "Operative Orthopedics."[3]

Description of Incision. The incision (Fig. 1A) is started on the anterolateral aspect of the leg, slightly in front of the fibula and about 3 inches above the ankle joint. It is continued distally to about the base of the metatarsal bones, crossing the ankle joint approximately at the juncture of the fibula and the tibia. The fascia as well as the transverse crural and the cruciate crural ligaments are incised down to the periosteum of the tibia and the capsule of the ankle joint. As a rule, both the anterolateral malleolar and the lateral tarsal arteries are also divided by this dissection. Following this, the extensor digitorium brevis muscle is divided in the direction of its fibers, or, if necessary, is detached from the site of its origin. Lastly, the superficial and the deep structures are incised, exposing the lower third of the tibia, the ankle joint, and the neck and body of the astragalus. Throughout the dissection care is taken not to damage any important structures.

Management of Fragmented Astragalar Body. After the ankle joint and the adjoining bones have been widely exposed, the fragments of the fractured astragalar body are taken out. As removal of the fragments progresses, it becomes easier to reach the fragments which lie in the deep portion of the joint. Neither the neck nor the head

of the astragalus are disturbed, since these two parts of the astragalus as well as the articular facets (anterior and medial calcaneal) joining them to the os calcis and the astragaloscaphoid joint are ordinarily not damaged.

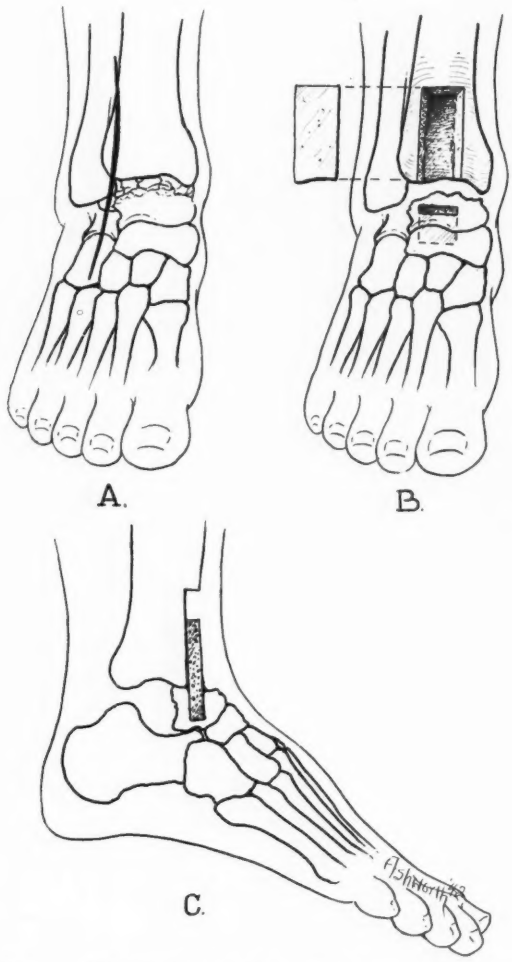


FIG. 1. Schematic drawing of fusion operation for the treatment of comminuted fractures and fracture dislocations of the body of the astragalus. A, anterolateral incision. B, sliding graft from distal, anterior surface of tibia and quadrilateral hole gouged in neck of astragalus. The sliding graft has been removed to permit a better view of the hole in the astragalar neck. C, sliding graft embedded in hole in astragalar neck. Note space left by removal of astragalar body, figures B and C.

Preparation and Fixation of the Sliding Graft. When removal of the bony astragalar fragments has been completed, a sliding graft, 1 inch wide and 2 inches long, is cut in the distal, anterior portion of the tibia. (Fig. 1B.) No cartilage is removed from the articular surface of the tibia except that which is attached to the distal end of the graft.

After the graft has been prepared, a quadrilateral hole is gouged in the neck of the astragalus. (Fig. 1B.) The hole should be about ¾ of an inch deep, and just large enough so that the end of the graft, when it is embedded, will fit snugly.

The foot is then placed in 100 to 105 degrees of equinus, and the previously prepared graft is slipped down and embedded in the hole gouged in the astragalar neck. (Fig. 1C.) The lower end of the graft can be further secured by packing pieces of cancellous bone around it. The upper end of the graft is held in place with sutures taken through the adjacent periosteum and the soft tissues over it.

Closure and Application of Cast. The incision is closed in the usual manner. A gauze dressing is applied over the wound, and sterile sheet wadding is placed over the gauze dressing. A cast is then applied from the groin to the toes, with the knee in extension.

Subsequent Care. Ten to fifteen days after the operation, the cast is taken off; the skin stitches are removed; and a nonpadded walking cast is applied from the knee to the toes. The second cast is equipped with a walking iron, since the patient is encouraged to walk as soon as he is able to bear weight.

CASE REPORTS

CASE 1. C. R. W., a white male, age sixty, was admitted to St. Vincent's hospital on December 3, 1937. Ten days prior to admission, he had sustained a fracture dislocation of the body of the right astragalus. (Figs. 2A and B.) The neck and the head of the astragalus, as is usual in these cases, had not been damaged by the injury. Because of the impending necrosis of the soft tissues in the posteromedial region of the ankle, the attending doctor had removed the dislocated astragalar body.

Examination disclosed a severe equinus deformity of the right foot. On the medial side of the ankle, which was extremely swollen, was a

normally healing incision with the stitches still *in situ*. Manipulation of the foot elicited considerable pain. A roentgenogram (Fig. 3) showed that the head and the greater part of the neck of the astragalus were in their normal position. The body of this bone and a portion of the neck were absent.

A B

Fig. 2. A and B, anteroposterior and lateral views of fracture dislocation of the body of the astragalus in Case 1. (Films submitted by patient.)

On January 24, 1938, approximately seven weeks after the injury, the operation described in this paper was carried out. The tibioastragaloid joint was exposed by means of the anterolateral incision, and a graft from the anterior surface of the tibia was slipped into the hole gouged in the neck of the astragalus. Pieces of cancellous bone were used for additional packing around the lower end of the graft. The foot was placed in slight equinus to prevent "rocker foot," and a cast was applied from the groin to the toes.

Except for circulatory changes, as evidenced by coldness and duskiness of the skin of the forefoot, the immediate postoperative course was uneventful. Fifteen days after the operation, a nonpadded walking cast with a walking iron was applied, and a few days later the patient was discharged from the hospital. The circulatory disturbance, however, persisted for two or three months, and was attributed to injury of the posterior tibial artery at the time the fracture dislocation was sustained.

Three and a half years after the operation the patient returned for re-examination, stating that he had had no pain during this interval. It was noted that both the foot and the ankle were of normal conformation. There was a small amount of flexion and extension of the ankle, but lateral motion in the distal tarsal joints was almost normal. The functional result was, however, good since the patient was able to run up and down stairs and to climb a ladder without discomfort. The roentgenogram taken at the time of this examination is shown in Figure 4.

Case II. C. F., a white male, age fifty-four, was admitted to St. Vincent's hospital with a swollen and inflamed left foot on June 29, 1941. He stated that he had fallen from a ladder on June 18, 1941. Roentgenograms showed a severely comminuted fracture of the body of the left astragalus. (Figs. 5A and B.)

The swelling and other local reactions were allowed to subside before operation was

attempted. On July 2, 1941, the ankle joint was exposed through the anterolateral incision. When the body of the astragalus was examined, it was observed that the comminution and the displacement were far more severe than the roentgenogram had indicated. There were four or five fragments, and each one was displaced. All of the fragments were removed, and a sliding tibial graft was embedded in the neck of the astragalus, according to the procedure described.

Recovery was uncomplicated. A walking cast was applied at the end of ten days, but weight bearing was not attempted for at least six weeks following the operation. At the end of four months, however, the patient was walking with only the aid of a leather anklet. Examination at that time showed practically no swelling, and the patient complained of little pain. A roentgenogram (Fig. 6) revealed that

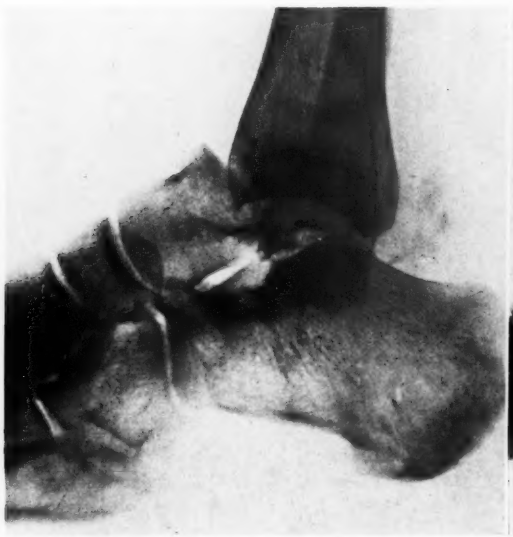
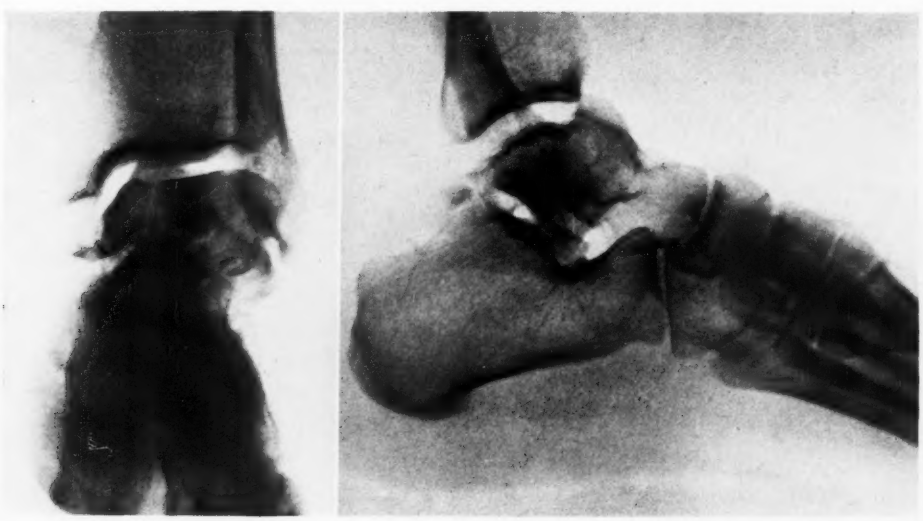


Fig. 3. Appearance of ankle joint in Case 1 following initial operation which was performed because of impending necrosis of the soft tissues. Note the undisturbed neck and head of the astragalus and the absence of the astragalar body. (Film submitted by patient.)

Fig. 4. End result in Case 1. This film was taken three and a half years after the performance of the corrective operation described in this paper.



A B

Fig. 5. A and B, anteroposterior and lateral views of comminuted fracture of the body of the astragalus in Case II.

fusion had already taken place. Further increase in the amount of bone in this area is expected.

DISCUSSION

The diversity of opinion relative to treatment of comminuted fractures and fracture dislocations of the body of the astragalus indicates that no one method has been entirely adequate. Some surgeons believe that dislocated fragments should be replaced when the astragalar body has been fractured.[4,5,10] Others believe that the fragments should be removed.[4] And some of those who favor astragalectomy include with this procedure backward displacement of the foot.[13,14]

Miller and Baker,[9] after their study of the various customary methods of treatment, counseled against astragalectomy, but advised subastragalar arthrodesis when reduction of fragments is not possible. Magnuson[8] was of the opinion that it is often impossible to replace the fragments of a seriously fractured astragalar body, to hold them in place, and subsequently to secure an ankle joint upon which it is comfortable to walk. He maintained that under these conditions it is necessary to arthrodese the ankle, but he stressed the fact that it is "no mean feat of surgery and should not be attempted without previous experience." According to Magnuson, this procedure gives a firm bony union between the astragalus and the tibia, and results in a painless, stable, useful foot with a minimum spring in the arch. There is, however, from 1 to 1.5 inches of shortening. Figure 253 in Magnuson's book on fractures shows an arthrodesis with fusion of the tibia to the os calcis and the neck of the astragalus.

According to Böhler,[1] compression of the body of the astragalus is rare. It was his belief that the body of this bone should, if possible, not be taken out because its removal causes severe and lasting disability. But Wilson[14] took the stand that removal of this portion of the astragalus is necessary since there is usually a great deal of displacement and the circulation is cut off. He drew attention to a compression fracture of the astragalar body which he called a "check fracture."

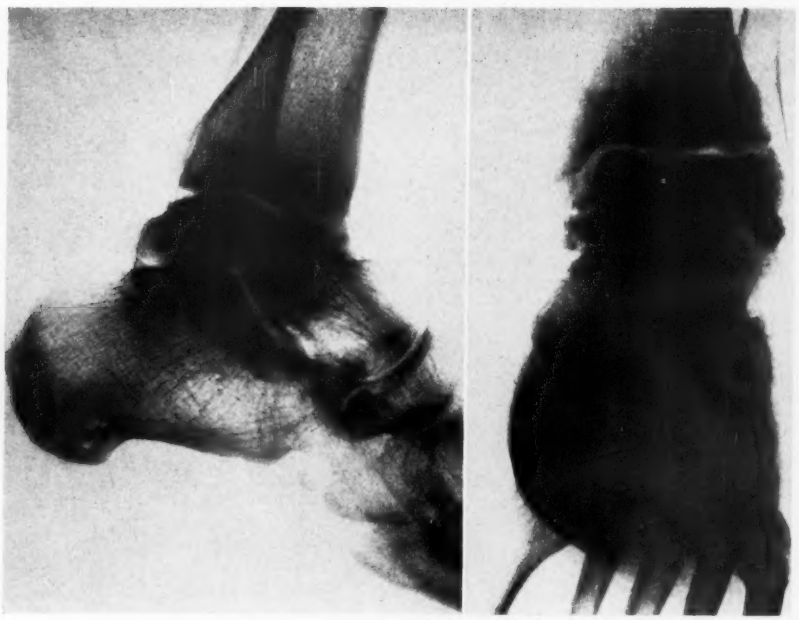
Fig. 6. End result in Case 11. This film was taken four months after removal of the fragmented astragalar body and sliding graft fusion of the tibia to the neck of the astragalus. Despite the roentgen appearance, only the middle and the anterior subastragaloid joints remain.

Shands,[11] following an analysis of 109 cases of fractures and dislocations of the tarsus, concluded that astragalectomy may be indicated, but that the results following this operation are not altogether satisfactory. And Hosford,[7] although he had at times been obliged to perform astragalectomy, was also inclined to believe that it does not give an adequately functioning foot. Then again, Campbell[3] in a small series of cases found that astragalectomy had given good results.

Gibson and Inkster[6] maintained that the prognosis in crushing fracture dislocations is poor. In their opinion, partial astragalectomy is unsatisfactory but complete astragalectomy may be satisfactory. Cabot and Binney[2] believed that the prognosis is apt to be poor, and went so far as to say that no operative procedure is likely to improve the condition.

In spite of the arguments in favor of astragalectomy, the fact remains that following astragalectomy the affected ex-

tremity is from 1 to 1.5 inches short. The foot itself is obviously deformed and the fitting of shoes is extremely difficult. Then, too, deformity is liable to be progressive, displacement is not necessary. In fact, the relationship of the foot to the ankle and the leg remains practically normal and there is no shortening of the extremity.



A B

FIG. 7. A and B, end result of a comminuted fracture of the astragalar body which was not managed according to the procedure outlined in this paper. Note the collapse of the astragalar body and nature's effort to fuse the anterior part of the tibia to the astragalus (in A). Note also the traumatic arthritis which subsequently developed (in B). The small amount of motion which remained in this joint was exceedingly painful.

and varus, particularly, is prone to occur. In addition, the adult patient generally continues to have more or less pain, which can be attributed to the fact that weight bearing is not on a normal joint.

Subastragalar arthrodesis and panastragalar arthrodesis, although they have supporters, also do not give entirely satisfactory end results. In comminuted fractures of the body of the astragalus it would seem that both the superior and the inferior joints are involved. Hence, if arthrodesis is to be done, the ankle joint as well as the subastragaloid joints should be fused. Arthrodesis of all these joints should give a painless foot. Yet there would certainly be not only stiffness of the ankle and most of the tarsal joints, but also some shortening.

The fusion operation I have described herein does not change the outward appearance of the foot. Furthermore, backward

An important consideration in this fusion operation is that the weight bearing thrust is placed on normal, undisturbed joint tissue. In astragalectomy, on the other hand, tissue not intended for weight bearing is called upon to carry out this task. The fusion operation now reported should, and actually does, allow flexion and extension of the foot on the leg. The two subastragalar facets and the astragaloscaphoid joint allow a rocking movement of greater or less degree.

Another important consideration in the fusion operation is that there is no tendency for the development of lateral deformity of the foot. It is, therefore, suggested that this procedure might also be considered in those cases in which paralytic calcaneus deformity is present without impairment of the lateral muscle groups.

SUMMARY

1. The customary treatment for comminuted fractures and fracture dislocations of the body of the astragalus has been astragalectomy or tarsal fusion. Results have, however, not been good.

2. An operation of technical simplicity is suggested for the management of these injuries. Briefly, the principal steps are (1) exposure of the tibio-astragalar joint by means of an anterolateral incision; (2) removal of the fragmented astragalar body; and (3) embedding of a sliding graft from the distal, anterior surface of the tibia into the neck of the astragalus.

3. The considerations of special importance in this operation are that the weight bearing thrust is placed on normal, undisturbed joint tissue and that there is no tendency for subsequent lateral deformity of the foot.

4. Experience indicates that the end result of this procedure should be a painless, normal appearing foot and ankle with good stability and function.

REFERENCES

1. Böhler, L. Fractures of the talus (astragalus). Ed. 4, pt. 2, p. 458. In the treatment of fractures (English translation by E. W. Hey Groves). Baltimore, 1935. William Wood & Company.
2. Cabot, Hugh, and Binney, Horace. Fractures of the os calcis and astragalus. *Ann. Surg.*, 45: 51. 1907.
3. Campbell, Willis C. Operative Orthopedics. Pp. 147–148. St. Louis, 1939. C. V. Mosby Company.
4. Davis, Benjamin F. Fracture-dislocation of the astragalus. *Surg. Clin. Chicago*, 3: 1461, 1919.
5. Ely, Leonard W. Old fracture of the tarsus. *Ann. Surg.*, 45: 69, 1907.
6. Gibson, Alexander, and Inkster, Robert G. Fractures of the talus. *Canad. M. A. J.*, 31: 357, 1934.
7. Hosford, J. P. Discussion on fractures in the region of the ankle-joint. *Proc. Roy. Soc. Med.*, 25: 1087, 1932.
8. Magnuson, Paul B. Fractures. Ed. 2, chap. 19, p. 314. Philadelphia, 1936. J. P. Lippincott Company.
9. Miller, Oscar Lee, and Baker, Lenox Dial. Fracture and fracture-dislocation of the astragalus. *Southb. M. J.*, 32: 125, 1939.
10. Montgomery, Albert H. Fractures through the neck of the astragalus. *Ann. Surg.*, 65: 495, 1917.
11. Shands, A. R., Jr. Fractures and dislocations of the tarsus: an analysis of a series of 109 cases. *Southb. M. J.*, 24: 1019, 1931.
12. Speed, J. S. and Boyd, H. B. Operative reconstruction of malunited fractures about the ankle joint. *J. Bone & Joint Surg.*, 18: 270, 1936.
13. Wilson, Philip D. Fractures and dislocations of the tarsal bones. *Southb. M. J.*, 26: 833, 1933.
14. Idem. Fractures and Dislocations of the Tarsal Bones, in Massachusetts General Hospital: Management of Fractures and Dislocations. Chap. 21, p. 544. Philadelphia, 1938. J. B. Lippincott Company.

THE LEVATOR ANI, COCCYGEUS AND PIRIFORMIS MUSCLES*

AGENTS IN THE CAUSATION OF COCCYGODYNIA, SUPERIOR GLUTEAL PAIN AND SCIATIC SYNDROME

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THE difficulties associated with the establishment of an accurate anatomopathologic diagnosis are many in the perplexing and complicated cases which have as their presenting complaint pain in the low-back area. The loose and conflicting usage of terms such as strain, sprain, sacroiliac subluxation, postural fault, congenital anomalies, fascitis, myofascitis, fibrositis, contractures, spastic piriformitis, herniated intervertebral disks, thickened ligamentum flavum, narrowed intervertebral spaces, and sciatica has contributed significantly to the confusion which besets this problem.

Each combination of cause and effect, whether conceived through sound observational pathways or via the exhilarating route of spontaneous inspiration, had its champions and its day of overemphasis.

There can be little satisfaction in conjuring up a composite picture of the female organs sacrificed on the altar of low-back pain. At the present time it is the intervertebral disk that rests uneasily in the warm rays of the spotlight. While recognizing that rupture of a lumbar intervertebral disk with pressure on one or more roots of the cauda equina is a very real and distressing condition, accurately diagnosable in a large percentage of cases and brilliantly cured by skilled surgical intervention, it is conceded that the precisely similar clinical syndrome may be produced by other mechanisms.

Barr, Hampton and Mixter (1937) stated that a clinical differential diagnosis in many cases is not possible. They emphasize the importance of a carefully taken history, thorough physical examination, detailed neurologic study and ordinary roentgenological investigation. Whenever disease of the disk is strongly suspected they advise lumbar puncture, chemical examination of the cerebrospinal fluid for total proteins and in many cases the use of lipiodal or air instillations for more accurate *x*-ray study of the lumbar spine.

The authors make no mention of the use of routine pelvic and rectal examinations in order to rule out regional disturbances which may be responsible for symptoms similar to those under consideration.

A review of the anatomy of the region displaying the intimate relations existing between sharp unyielding ligaments, actively contracting muscle bundles and relatively huge nerve trunks and blood vessels together with the bones and joints of the pelvis should excite more than a passing interest in these structures from the standpoint of pain arising in and around them.

The sciatic nerve is the longest in the body and subject to baneful influence throughout its entire length. Woltman states that no type of pain is pathognomonic. A given disease may exhibit many kinds of pain which, being subjective, necessitates a most meticulous and cautious interpretation. Moreover remissions of pain are common in the various low-back and sciatic syndrome states, and the frequency of low-back pain as a manifestation of neurosis has been frequently emphasized.

The sacral plexus is formed by the lumbosacral trunk from the fourth and fifth lumbar and by the anterior divisions

* Read before the Graduate Group in Surgery of the New York University College of Medicine, March 26, 1942.

of sacral nerves 1-2 and 3. The plexus lies on the anterior surface of the piriformis muscle in 90 per cent of cases and within the muscle in 10 per cent of cases. Morris' Anatomy states that the sciatic trunk may pass above or below the piriformis muscle or the trunk may split and pass around the muscle or the nerve may perforate the muscle. Also there may be a splitting of both nerve and muscle giving rise to any possible arrangement of the four parts. In 10 per cent of cases the piriformis muscle is perforated by the common peroneal nerve. The sacral plexus lies behind the pelvic fascia and the branches of the hypogastric artery. It is also dorsal to intestinal coils with the sigmoid colon in front of the left plexus and the lower part of the ileum in front of the right plexus.

The piriformis is the only muscle which may be said to bridge the sacroiliac joint and it has very intimate anatomical relations with it and also with the sciatic nerve.

In 1928, Yoeman published the first reference to the piriformis muscle as being closely concerned in the production of sciatic pain. He stated that any lesion of the sacroiliac joint can give rise to inflammation in the piriformis muscle and its fascia.

Freiberg and Vinke (1934) published their researches relative to the anatomy and disorders of the piriformis muscle. They discovered the muscle-nerve variations and concluded from clinical studies that sciatic pain may occur when the fibers of the plexus perforate the piriformis and spasm takes place.

Freiberg and Vinke suggested that the relief of sciatic pain by manipulative procedures may have its explanation in the release of adhesions between the piriformis muscle and the nerve sheath rather than from stretching of the nerve trunk which they believe must be a most infrequent result of straight leg raising and other manipulative or limb stretching maneuvers. They suggest, too, that perhaps it is not too radical to consider surgical attack upon the tendon of the piriformis at its trochanteric attachment in some cases of recalcitrant and incapacitating pain.

In a later article Freiberg (1941) reported upon twelve patients who had been subjected to piriformis muscle interruption. Three of the twelve demonstrated absence or great weakness of the Achilles reflex, a finding considered very significant in cases in which prolapse of an intervertebral disk is suspected. Nevertheless two of these patients (who apparently were not systematically investigated from the disk standpoint) experienced complete relief from pain following operation. The third case was a failure.

Stockman (1920) described fibrositis in great detail. He considered it to be an inflammation of the white fibrous supporting tissue of the muscle. A low-grade serofibrinous exudate was first produced which eventually gave rise to fibrous and tendinous contractures or capsular thickenings.

The Fifth Rheumatism Review (1939) accepted the term, for want of a better, as indicating the syndrome of muscular tenderness, particularly at insertions, and pain on stretching of the part.

In this condition there is characteristic tenderness at the periosteal attachments, and there may be pain and tenderness along the segmental distribution i.e., sciatic syndrome. The clinical reports and pathologic studies by Gratz point to a sustained interest in the musculo-aponeurotic and ligamentous origin of low-back pain.

Heyman believes that the clinical evidence is convincing enough to place fibrositis as one of the three most common forms of rheumatic disease, the other two being atrophic and hypertrophic arthritis. He, therefore, concludes that fibrositis is a provisionally accepted entity causing low-back and sciatic pain which may be relieved by posterior fasciotomy in selected cases not yielding to conservative treatment. His operation is directed toward producing release of tension of the ligaments and fascias and muscles attached to the posterior iliac spine and to the posterior

one-third of the crest of the ilium by subperiosteal stripping laterally, medially and inferiorly, together with division of the sacrospinalis fascia when pain or tenderness is present there.

Heyman reports twenty-six such operations with cures in twenty and partial relief in three. Two of the failures were the result of operations performed for insufficient indications.

Ober's fascia lata section is devised upon a very similar basis. He reports excellent results in carefully selected patients. Ober reported one case in which a ruptured nucleus pulposus had been removed and spinal fusion performed. This patient had persistence of pain which was completely relieved after his particular brand of fasciotomy had been produced. He states that when the patient is suffering greatly fasciotomy can be considered a conservative procedure.

Using the foregoing to indicate the lack of accord which besets this problem, it is our aim to bring to the fore the most important consideration of regional and referred pain resulting from inflammation and spasm in the levator ani, coccygeus and piriformis muscles and their fascias.

In 1937, Thiele reported a series of eighty patients with coccygodynia and/or pain in the supragluteal region and/or pain down the back of the thigh who were treated by massage of the pelvic muscles listed above. He reported 60 per cent cured, 33.7 per cent definitely improved and 6.3 per cent unimproved. Thiele believes that there is a sound anatomic basis for the causation of coccygodynia by spasm of the levator ani and coccygeus muscles and for the production of supragluteal pain and pain down the back of the thigh by spasm of the piriformis muscle.

In thirty-one of thirty-three patients with pain in the supragluteal region or down the back of the thigh he found piriformis muscle spasm. In this general classification of patients, coccygodynia is the more common finding and oftentimes it is so severe that the supragluteal pain or its radiation down the back of the thigh is elicited only on direct questioning.

Since I was introduced to this syndrome I have searched for, discovered and treated twenty-eight patients. The following eight cases are reported briefly as demonstrating varying points of interest:

CASE REPORTS

Case I. Mr. L. S., a truck driver, suffered with pain of extreme severity in the right supragluteal region and down the back of the thigh, of sudden onset following a twisting injury sustained when he slipped while carrying a large can of cream. He stated that he had been treated by a traumatic surgeon retained by his company during a period of three weeks. *X*-rays of his spine had been taken and he had been subjected to various methods of manipulative and physiotherapy. Experiencing no relief he had independently consulted an osteopath with no better fortune. Careful physical examination revealed the one outstanding finding of an extreme degree of tenderness and spasm of the right piriformis muscle. The muscle was massaged thoroughly and he was instructed to apply heat to the area by the use of sitz baths and a heating pad and to return in two days. He failed to return and the writer was left with the impression that the patient had probably returned to the osteopath as the lesser of two evils. Several weeks later I was most agreeably surprised to learn, from the patient's wife that he had not returned because he had been entirely free from pain following the first treatment and that he had not considered it necessary. This patient has been followed for nearly three years and he has never had a recurrence.

Case II. Mrs. W. T., age twenty-seven, had been delivered of her first child by radical operative intervention including trial forceps delivery, deep episiotomy and finally a laboriously executed version and extraction five months before appearing at my office. She had consulted two gynecologists seeking relief from pain situated deeply in the vagina and a sense

of weight referred to the rectum. She complained also of a dull constant sacral backache which she stated "seemed to empty into the rectum." Both gynecologists carried out endocervical cauterizations without effecting any change in the grade and character of the complaints. My diagnosis was bilateral low-grade inflammatory infiltration and spasm of the levator ani and coccygeus muscles. Four massages carried out at three day intervals succeeded in completely relieving the complaints. Interestingly enough, this patient was delivered easily of her second child eight months ago. She is now under my care again for treatment of levator ani-coccygeus muscle spasm and associated pain and ache, right-sided meralgia paresthetica of moderate severity and external hemmorrhoids grade I, and skin tags. Massages and physiotherapy in the form of heat served to provide complete relief.

Case III. Mrs. S. S., twenty-four years of age, when first seen was about three months along in her first pregnancy and complained of severe backache. She stated that at seventeen, while dancing professionally, she had fallen and had injured her back, following which she had never been free from backache. She believed that the pregnancy had aggravated the backache which was situated in both supragluteal and sacroiliac regions radiating to the tip of the coccyx. Examination revealed the positive findings of marked tenderness and spasm, bilaterally, of the coccygeus and levator ani muscles. It was not possible to palpate accurately the piriformis muscles in this patient. Five massages served to provide her with the first lasting relief she had experienced since her fall seven years previously.

Case IV. Mrs. C. B., twenty-six years of age, suffered with coccygodynia which developed during the course of her second pregnancy. This condition was completely relieved by two digital massages of the levator ani and coccygeus muscles. It is instructive to observe that this patient subsequently returned complaining of "floppy" sensations in her abdomen and pelvis. A remarkably mobile retroverted uterus was satisfactorily "anchored" in the anteverted position by means of an intravaginal pessary. There was no pain or backache associated with this uterine displacement.

Case V. Mr. H. M., thirty-four years of age, a farmer and factory employee, had bilateral superior gluteal pain which radiated down the thighs and was greatly aggravated by riding the tractor. *X*-ray films were negative. Bilateral massage of the piriformis, levator ani and coccygeus muscles and associated ligaments was carried out for eight treatments with marked improvement.

Case VI. Mrs. F. J., forty-six years of age, a picker in onion fields, suffered with an extreme degree of coccygodynia associated with lumbosacral pain radiating down the right thigh to the knee. In this patient the involved muscles and ligaments were board-like to palpation and were extremely sensitive for the first two or three treatments. She received twelve massages and ten graduated hypodermically administered doses of a milk extract foreign protein. She was discharged much improved and was instructed to return for reexamination and possibly for an additional course of treatments.

Case VII. Mrs. C. H., twenty years of age, had recently been through a very traumatizing forceps delivery of a nine pound first baby. A markedly painful classical coccygodynia was totally relieved by six massages directed bilaterally to the levator ani and coccygeus muscles and fascias.

Case VIII. Mrs. O. H., thirty-six years of age, had undergone cholecystectomy and appendectomy in 1931. In an automobile accident in 1940 she sustained a fracture of the right humerus and pelvis. Recovery was protracted but complete. In June, 1941, supravaginal hysterectomy was performed for the removal of a rapidly growing fibroid uterus associated with severe pelvic pain and backache. Recovery was uneventful but for persistence of severe backache which radiated down the right thigh posteriorly and from the lumbodorsal and right sacroiliac region to the right femoral head and greater trochanter. Examination revealed marked spastic piriformitis and levator ani and coccygeus muscle spasm especially on the right side. Eight treatments produced gratifying subjective improvement although the muscles remained abnormally firm to palpation.

EXAMINATION

Levator ani and coccygeus muscles are easily felt with the patient in the lithotomy or Sims position. Spasm and tenderness are discoverable by lateroposterior digital palpation. The piriformis muscle is much more

difficult to grasp with the finger-tip. I have discovered that it is most easily reached when the patient is in the exaggerated lithotomy position. Then the muscle can be definitely located just beyond the sacrospinous ligament.

The muscle can be felt to belly out when the extended thigh is externally rotated. In heavy, thick set patients particularly in whom the anal canal is long, narrow and unyielding I have been unable to reach the piriformis. However, when it can be reached, which is most often the case, its texture and sensitivity can be helpfully compared with its fellow on the opposite side.

Freiberg described a sign of piriformis spasm which consists of limitation of motion in inward rotation of the fully extended thigh.

The digital elicitation of pain and tenderness is a more positive finding than might be suspected. The patients complain bitterly of the pain and tenderness whereas the unaffected side may be actively manipulated without the production of more than passing discomfort.

In the dissecting room it has been demonstrated that the sciatic nerve can be pinched between the lower border of the piriformis muscle and the upper border of the sacrospinous ligament. Similarly the superior gluteal nerve can be pinched between the lower border of the gluteus medius muscle and the upper border of the piriformis.

TREATMENT

Massage was originally used to discover whether or not the digitally diagnosed muscle spasm could be relieved by this simple method. In the event that the patient does not show a definite degree of subjective improvement after the first four to six massages over a period of approximately two weeks, orthopedic or other consultation should be sought.

Thiele's series had an average of eleven treatments over an average period of eleven weeks.

Wilson, discussing Thiele's paper, pointed out the interesting finding that eight out of twenty-two patients in his series complained of pain in the lower portion of the abdomen. In every instance this pain followed the course of the iliohypogastric and ilioinguinal nerves and could be exaggerated by pressure on the piriformis muscle near its origin on the affected side. Six of this group of eight cases were relieved by massage of the piriformis muscle alone and the other two were cured by a combination of anal operation and massage.

COMMENT

Obviously there remains a great deal to be done and said concerning this general problem of low-back pain, coccygodynia and sciatic syndrome. It has not been the intention of the writer, in this discussion, to give the impression that the described conditions and the indicated nerve-musculofascial relationships constitute definite clinical entities for which satisfactory treatment can be invariably delivered.

On the contrary it is the express purpose of this paper to emphasize the loose linkage of cause and effect as indicated for these states and to point out that so much of the evidence may be classed as circumstantial.

Nevertheless it is the author's conviction that the muscles and related structures herein considered can and do serve as the direct or indirect causative agents in various cases of low-back and sciatic syndrome pain. Therefore, all such states have not been adequately studied unless this consideration has been explored.

REFERENCES

1. Barr, J. S., Hampton, A. O. and Mixter, W. J. Pain low in the back and "siatica" due to lesions of the intervertebral disks. *J. A. M. A.*, 109: 1765, 1937.
2. Craig, W. M. and Walsh, M. N. Neuroanatomic and physiologic aspects and significance of sciatica. *J. Bone & Joint Surg.*, 23: 417, 1941.
3. Ely, L. W. Coccygodynia. *J. A. M. A.*, 44: 968, 1910.
4. Freiberg, A. H. Sciatic pain—its clinical significance. *Obio State M. J.*, 30: 21, 1934.
5. Freiberg, A. H. Sciatic pain and its relief by operation on muscle and fascia. *Arch. Surg.*, 34: 337, 1937.

6. FREIBERG, A. H. Fascial elements in associated low-back and sciatic pain. *J. Bone & Joint Surg.*, 23: 478, 1941.
7. FREIBERG, A. H. and VINKE, T. H. Sciatica and the sacroiliac joint. *J. Bone & Joint Surg.*, 16: 176, 1934.
8. GRATZ, C. M. Fascial adhesions in pain low in back and arthritis. *J. A. M. A.*, 111: 1813, 1938.
9. GRATZ, C. M. and MEEKER, L. H. Role of fascia in myosynovitis and adhesions. *Surg., Gynec. & Obst.*, 69: 627, 1939.
10. HARMAN, J. B. Fibrositis and pain. *Ann. Rheumat. Dis.*, 2: 101, 1940.
11. HEYMAN, C. H. Relief of low-back pain and sciatica by release of fascia and muscle. *J. Bone & Joint Surg.*, 23: 474, 1941.
12. OBER, F. R. Fasciotomy. *J. Bone & Joint Surg.*, 23: 471, 1941.
13. STEEL, W. A. The relief of chronic backache and sciatica by minor surgical measures. *New England J. Med.*, 219: 474, 1938.
14. STOCKMAN, R. Treatment of sciatica due to fibrositis. *Ann. Rheumat. Dis.*, 2: 77, 1940.
15. THIELE, G. H. Coccygodynia and pain in the superior gluteal region. *J. A. M. A.*, 109: 1271, 1937.
16. YEOMAN, W. Relation of arthritis of the sacroiliac joint to sciatica with analysis of 100 cases. *Lancet*, 2: 1119, 1928.

IN a condition such as osteo-arthritis of the hip, manipulation often has been performed with the patient under the influence of anesthesia, and sometimes considerable relief has been obtained thereby. It has been suggested that the administration of an anesthetic agent may play a part in the production of such relief.
From "Clinical Anesthesia" by John S. Lundy (W. B. Saunders Company).

CESAREAN SECTION

EVALUATION OF TYPES OF SECTION AND THEIR INDICATIONS

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SEVERAL extensive recent surveys have again focussed the mind of the writer upon that topic of perennial controversy and comment, the cesarean section.

A significant debate upon this entire subject followed the presentation of a paper by Dr. Edward L. King before the American Gynecological society in 1940. Dr. King's paper was entitled "A Comparison of Two Cesarean Section Surveys Carried on in the City of New Orleans."

The first survey ran from 1921 to 1926 and included an analysis of 300 cesarean sections; these constituted 0.48 per cent of all deliveries and 1.8 per cent of hospital deliveries. The second survey ran from 1927 to 1936, during which time 1,108 sections had been performed; these represented 1.19 per cent of all deliveries and 2.05 per cent of patients who were hospitalized. In the first series the maternal mortality rate was 16.1 per cent, while in the second it had dropped to 5.9 per cent.

In the first group 3 per cent of all patients operated upon died of sepsis or peritonitis, while in the second group 2.25 per cent plus, perished from the same cause.

In the first group 58.3 per cent were treated by classical sections with the probability that many of the eighty-four sections not described as to type were of the classical variety.

In the second group the classical sections had fallen to 49 per cent.

The febrile morbidity in the two series was 63.5 and 61.3 per cent, respectively. This brief summary of Dr. King's statistics is quoted because it is the basis for the comments which follow.

Dr. King's conclusions, among others, were that the average rate of 1.19 per cent cesarean sections in New Orleans was too high a proportion, although there were possibly not enough sections performed during the period covered by the first survey; that the superiority of the low cervical operation is clearly shown and that the indications are more clearly set forth in the records of the past few years and on the whole seem to be more judiciously placed in the second series.

In the discussion which followed the above presentation, several phases of the subject were considered which seem to merit further comment: (1) Is the increase in the relative number of cesarean sections, now the general practise throughout the country, justified or not? (2) The mortality rates of the operation have decreased appreciably during the past twenty years. Why? (3) Is the low cervical section so greatly preferable to the classical type that the latter should be pronounced obsolete as advocated by Dr. Lee in the discussion of King's paper.

With regard to the first proposition, the writer believes strongly that with the steady improvement of technic the cesarean section should be utilized whenever a difficult labor with its inherent dangers to mother and child is anticipated.

The surgical approach in general has been revolutionized during the past two decades. Procedures formerly invoked only upon life saving indications are now routine in the management of lesions causing moderate illness or discomfort. The great development of gallbladder, intestinal, thoracic and indeed every variety of surgical therapeusis, has come about as a result of the increased safety and the decreased suffering in operative procedures.

Obstetric surgery is bound to follow this general trend, and when, as Adair says, "any maternal mortality in excess of 1 per cent and any fetal mortality in excess of 2 per cent is too high," it is apparent that section is a safe operation. Danforth surveyed 343 sections done by his own group with a mortality of 0.88 per cent. When it is realized that these figures represent all types of cases, from purely elective to grave emergencies, it is true that abdominal hysterotomy is indeed a safe procedure.

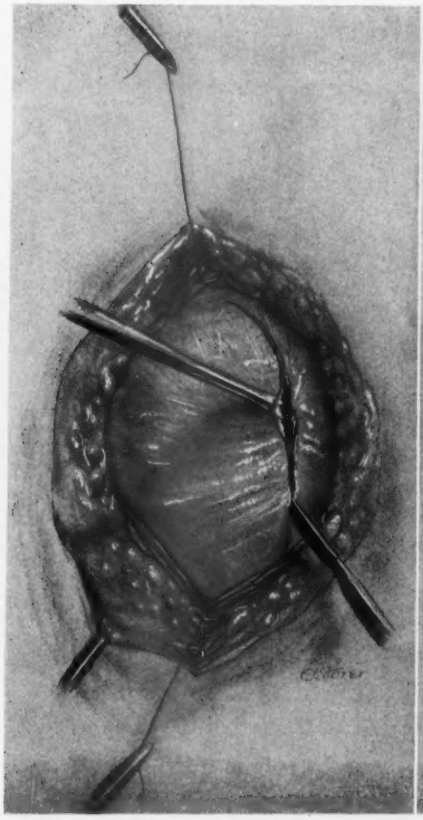

FIG. 1. The uterus has been sutured to the abdominal wall and the formation of the peritoneal flap is begun.

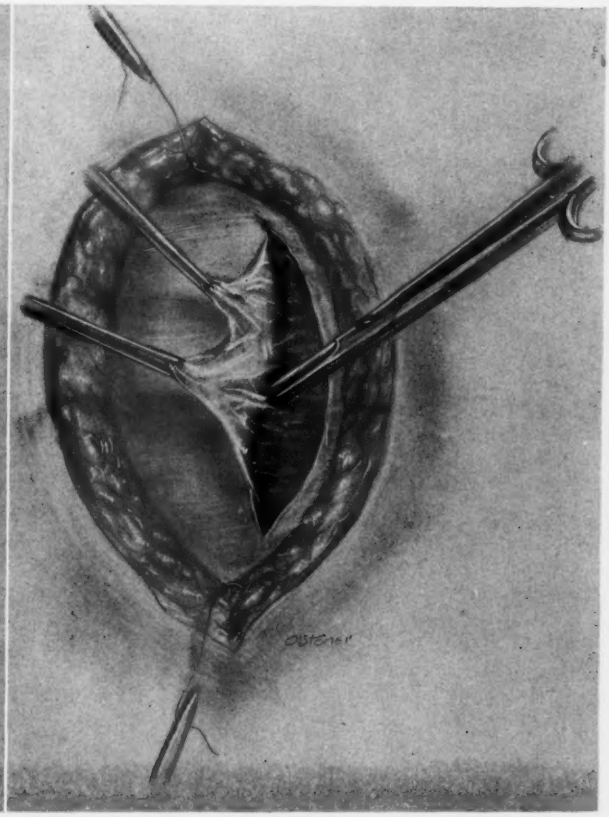

FIG. 2. The peritoneal flap being developed.

However, a needed advance is the increase in ratio between planned, elective section and those performed as a last resort when all other means of delivery have failed.

The acceptance by the physician of the fact that a stormy labor can be foretold in the great majority of patients long before the event, or at worst, a very few hours after labor has begun, and that the danger of cesarean to both patients varies almost in direct ratio to the length of time intervening between the onset of labor and the performance of the operation, will still further reduce both morbidity and mortality.

On the other hand, there are still too many sections done on infected, exhausted women, when the chance of infant survival is small and the danger to the mother very great. Until some form of truly extraperitoneal section is developed and widely taught (and the ordinary low cervical section is not an extraperitoneal procedure in any sense) embryotomy offers a considerably better prognosis for the mother although the infant is inevitably lost.

In view of the above statements it is my considered opinion that the indications for the truly elective section will continue to be expanded, whereas performance of the section of emergency, especially insofar as it relates to infected patients, will

be more and more curtailed, at least until further knowledge makes the use of extraperitoneal procedures more nearly universal.

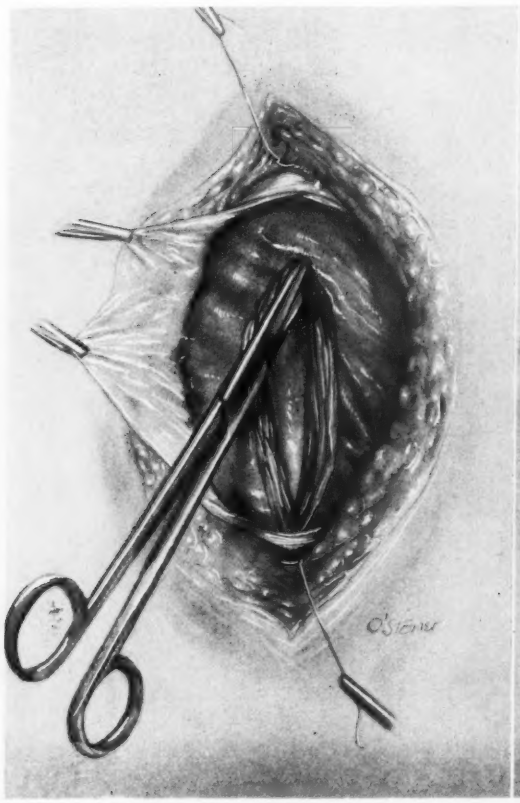

Fig. 3. The underlying uterine wall is being incised.

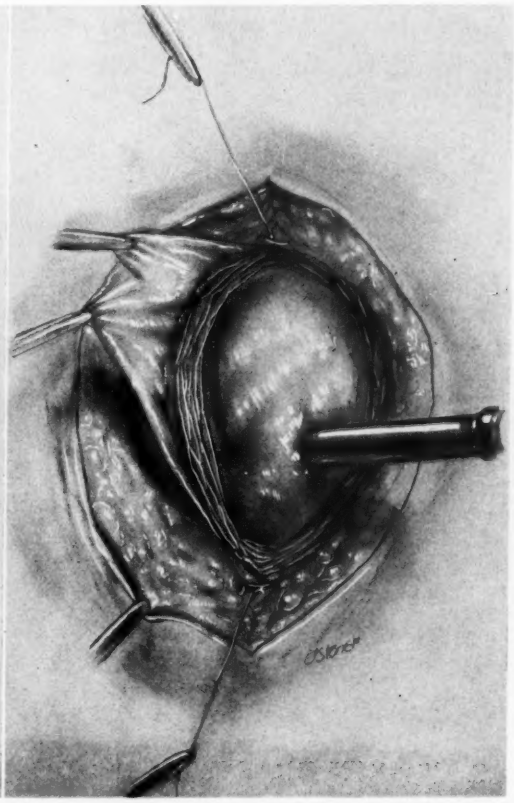

Fig. 4. The membranes bulge through the incision and the liquor amni is being drained off.

Concerning the second question: as to the causes of the manifestly lowered mortality of cesarean sections during the past twenty years or more, one must again turn to the record of surgical achievement as a whole. Certainly a review of the results in cholecystectomy, thyroidectomy, thoracic surgery, compound fractures, indeed any division of operative medicine will reveal an improvement parallel to or even more striking than that disclosed in the reports upon cesarean section.

This advance is due to several factors: Surgeons are better trained than formerly and today, even in the smaller communities, there may be found young men developed in carefully supervised residencies, whose skill and fundamental knowledge is of the highest grade. Surgical technic, anesthesia, the wide use of blood transfusion, increase in precision methods of diagnosis, and other details have combined to make surgery in general grow much safer year by year.

Insofar as cesarean section is concerned, the same things are true. Kamperman, of Detroit, in the discussion so frequently alluded to in this paper said "In analyzing the statistics, it was interesting to see when the improvement had come. The low cesarean section which had in the meantime become much more popular, seemed to have been partly responsible for a lower maternal mortality. But in my own mind I am not convinced that that was a great factor. We have become more conscious of the danger of cesarean section in the presence of infection and that consciousness developed just about the time when we began to substitute the low cervical section for the classical type. It would seem that knowing when not to operate was an important factor in the improve-

ment. More important still seemed to be the fact that eclampsia was no longer considered an indication for cesarean sections too loudly as a complete answer to the perils of cesarean section.

The one great place for the low section

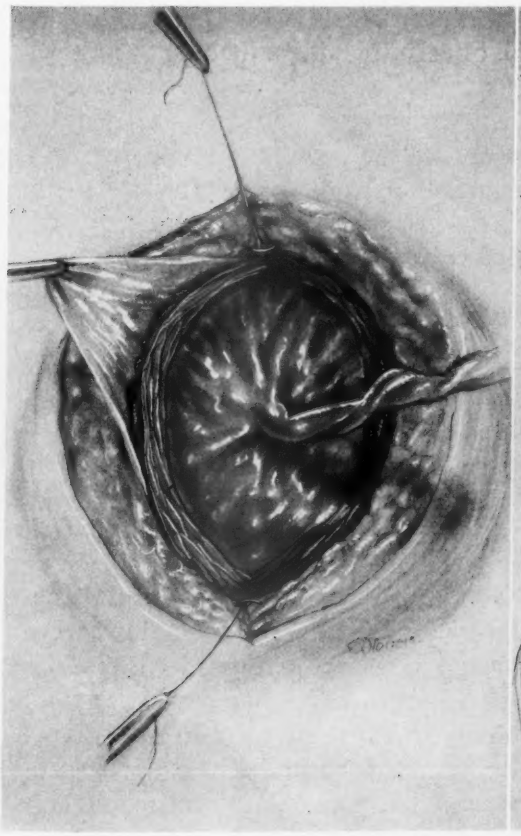

Fig. 5. The baby has been delivered; the placenta presents in the wound.

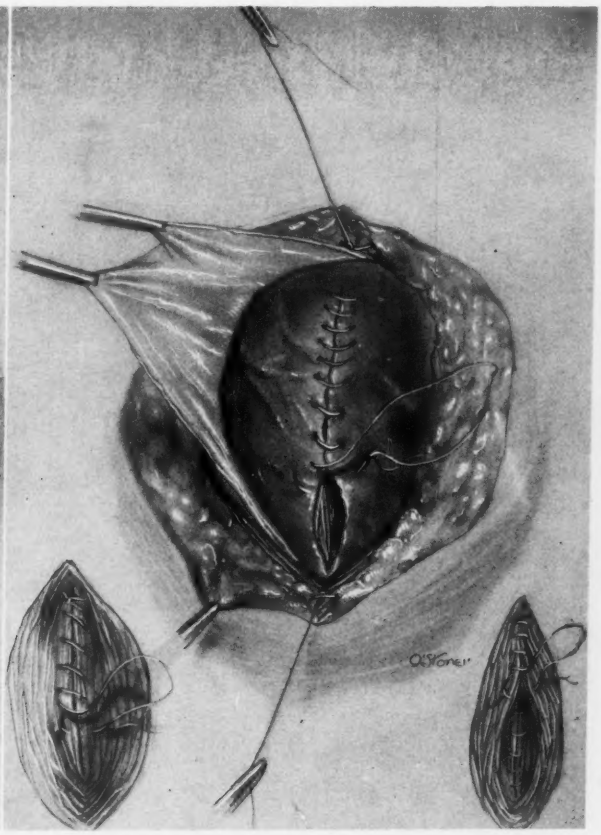

Fig. 6. The uterine muscle is closed.

and I think this change was the chief cause for the improvement in maternal mortality."

All in all, it appears clear that the low section, although it plays some part in the better mortality records, is by no means the overwhelming influence as is so often stated.

The third subject offered for debate is the question as to whether the low cervical section is so far preferable to any type of corporeal hysterotomy that the latter should be pronounced obsolete. The writer has no fault to find with the low section, esteeming it to be an operation intelligently devised and of great value to meet certain well defined indications. He does believe, however, that this procedure has been invested with a certain glamor and hailed would seem to be in the patient with a failed test of labor, when the membranes have been ruptured for some time and when the lower uterine segment is well thinned out and distended by the pressure of the presenting part. Under such conditions the woman may be potentially infected, and it is reasonable to believe that should suppuration ensue, drainage under the bladder and along the parametrium offers a better chance of localization in an accessible area than occurs if the infected uterine wound lie in the body of the uterus.

It has been claimed that there is less tendency to peritoneal adhesion following section, but if the so-called classical operation be performed with a covering flap of uterine serosa, as will be described, the danger of postoperative adhesion is quite unimportant.

There are claims made for the operation, with which I frankly disagree, a notable one being that the bleeding is less. After observing many operators in their clinics, one gets the impression that there is practically no difference in the bleeding during a well done section whether it be of the corporeal or cervical type. Indeed, I have seen violent and most alarming hemorrhage occur in the clinics of some of the leading proponents of this operation in America.

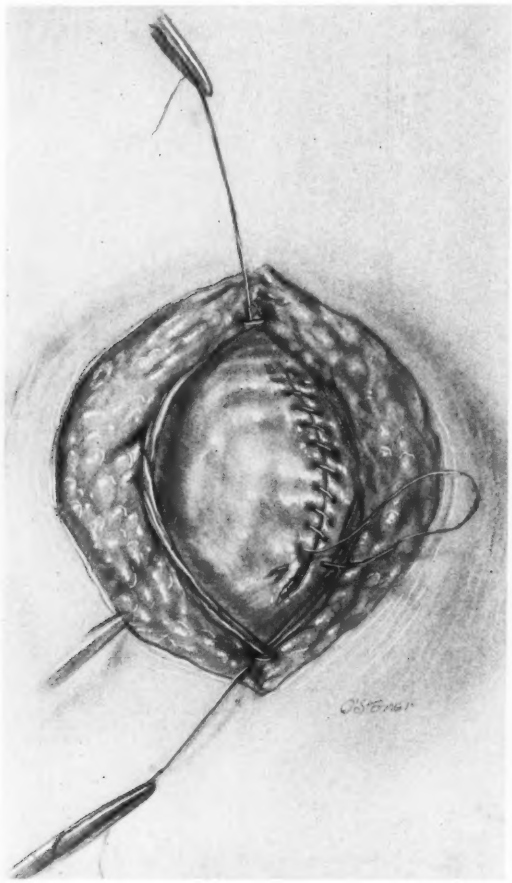

FIG. 7. The peritoneal flap completely covers the uterine incision and is being sutured in place.

It is also commonly said that the low flap operation is quite as simple as the classical procedure, which does not appear to be the fact. It is true that for the trained surgeon the operation offers no difficulties but emphatically it is not as easy and is far more time consuming than the corporeal incision. Furthermore, the tissues about the urinary bladder are more sensitive and for him who advocates the routine use of local anesthesia in hysterotomy, the time required for successful infiltration is far greater in the low type.

Concerning subsequent rupture of the scar there is but little to choose between the two operative sites. Certainly the lower uterine segment is the seat of most spontaneous ruptures of the uterus and as the low operation is more and more often performed so there will be increasing numbers of scar ruptures reported.

The great point seems to be the increased safety of the cervical section in all cases, as compared to the older form. Three sets of statistics have been adduced which seem to present a fair estimate as to the matter of morbidity.

F. H. Falls of the University of Illinois reported 200 cesarean sections, every other one done by the classical, alternating with the low cervical. The operations were performed in the same room, Falls opening and closing the skin personally. The same nurses and interns were in attendance and the patients received the same pre- and postoperative care. The result of the study was that there is practically no difference between the two operations.

In analyzing the amount of postoperative distress, $\frac{1}{12}$ gr. more morphine was used to keep the patients comfortable who had classical sections than was required for those having low cervicals. Falls says "we feel that the evidence in this series for the low cervical is not very strong and in the hands of the same operators about the same results will be obtained."

Carl Henry Davis found in checking the temperature morbidity that in his classical sections there was a slightly lower incidence of morbidity (51 per cent) than in the low cervical cases (60 per cent). In truly infected patients it is my opinion that no type of hysterotomy in which the peritoneal cavity is invaded is permissible short of hysterectomy. Here vaginal delivery by embryotomy, a truly extraperitoneal operation as the Latzko or the Waters pro-

cedure, sometimes the Gottschalt-Portes exteriorization or removal of the uterus are the only sound methods of attack.

The most recent survey of this subject is that of Ryder* who studied all of the sections performed at the Doctors Hospital, New York, from the opening of the institution in 1930 to the same period 1940. There were 330 sections performed, 218 or 66 per cent being classical and 100 or 30 per cent low flap. The remainder were extraperitoneal or some other variety of operation.

Ryder's conclusions from his study of the statistics were that low flap sections were followed by a higher puerperal morbidity than were the classical in those performed before labor, in electives, in those performed after labor had begun and in all sections considered together, in a survey of all the hysterotomies performed in ten years by many different operators at the Doctors Hospital.

The mortality rate was low, there being four deaths in the 330 operations or 1.2 per cent and the mortalities were twice as high following low flap operations than when the classical variety was employed. Ryder adds, however, that the total number of maternal deaths was so low that conclusions taken from them cannot be very convincing. And also that when the causes of these deaths are studied, a candid opinion must be that the type of section had little to do with the results.

But after all, how often does one meet the neglected, infected type patient? In one urban area (Philadelphia) I have collected the sections done in most of the hospitals during 1940 (to December 1st) and have been surprised to learn that of 580 sections, twenty-four or under 4.2 per cent could be described as being of the neglected dystocia variety. Speaking then for one large city (and I make no comment upon rural areas or other communities, about which I am unacquainted) the number of these neglected cases has reached a gratifyingly low number.

If it be true, as is so often affirmed, that the low section offers much greater protection against the spreading of an already existing infection than does the corporeal type, it is also true that only one cesarean patient in twenty presents such infection and hence the alleged protection is uncalled for in the remaining 95 per cent.

In this connection it is notable that in certain clinics the test of labor seemed unnecessarily prolonged. Records of active labor of from twelve to thirty hours in the hospital and closely observed with rupture of the membranes of from two to eighteen hours before hysterotomy were noted, and these in women who were known to have pelvic contraction and who had been carefully studied in prenatal dystocia clinics.

It seems that truly elective section long before the point of potential infection and exhaustion of the patient would be a wiser procedure in skilled hands than this excessive dependence upon natural forces which have already shown their incapacity.

From the standpoint of comparative statistics, the cesarean section is unique among surgical operations, especially if an evaluation be attempted of the comparative safety of different types of operation. If one were to make a similar survey of let us say, cholecystectomy, it would be found that the technic in general and the experience and training of the operator would be on much the same level, since no one attempts the operation who has not the necessary skill and the requisite operating facilities.

Cesarean section, however, is a procedure so technically simple that it is performed by almost anyone who practices obstetrics. It is a common thing to hear men who limit themselves to obstetrics announce that they do no abdominal surgery whatever except cesarean sections. This is also true of other physicians who do not even claim especial training in this branch of medicine. The only way in which a definite conclusion may be reached as to

* Ryder, George H. A comparison of the classical and lower segment cesarean section. *Am. J. Obst. & Gynec.*, 41: 1029, 1941.

the value of various technics, is to conduct a series of operations of the different types in the same institution, with the same operators and the same anesthetic, pre- and postoperative management. Then and only then will the true status of corporeal, low segment, and other varieties of hysterotomy be definitely established.

This has been done in part by Falls and by Davis, whose results have been quoted above.

From the foregoing arguments certain opinions of the writer may be summarized as to the place of various types of cesarean section to meet differing indications.

The corporeal or low fundal section is indicated in all elective cases, including operations done for placenta previa and abruptio placentae. This because the method is the simplest, quickest and lends itself most readily to infiltration analgesia. It is just as safe under these circumstances as any other procedure.

The low cervical section is indicated in women who have undergone a test of labor, in whom the lower uterine segment is well distended by the presenting part and who may or may not be potentially infected.

Neither of these operations is wise when definite infection is present, since neither protects the peritoneal cavity against spill. Under such circumstances vaginal delivery by whatever means is available, truly extraperitoneal section, exteriorization or hysterectomy are the only justifiable procedures.

For a number of years I have followed a somewhat specialized technic for the elective section, with satisfactory results for both mother and child. Elective sections are almost all done under local anesthesia, with recourse to inhalation anesthesia in but 1 per cent of the cases.

There have been 204 of these hysterotomies with the loss of no mother and three babies.

There have been no known ruptures of the scar, and in twenty-four of the patients repeat sections have been performed, no adhesions or weakness of the scar being disclosed in any of them.

It must be clearly understood that the operation here advocated is a purely elective procedure, done before the onset of labor or very early in the first stage, the indications being generally cephalopelvic disproportion, toxemia, placenta previa or systemic disease of the mother of a nature in which hysterotomy is deemed the most conservative form of delivery.

In sections of emergency, either the low form or much preferably the Waters technic is advocated. It follows then that the mortality rate here given is not that of section as a whole, but applies only to the low corporeal incision done under local anesthesia as a purely elective procedure.

The technic of the operation about to be described requires for its success meticulous observance of a number of details, insignificant in themselves but all contributing to a smooth convalescence.

The operating team must be trained for silence as noise in the operating room, the skittering of buckets across a tiled floor, clatter of instruments and conversation all tend to awaken and frighten the patient, who has been calmly sleeping before. The obstetrician should always discuss the details of the delivery with the woman, either during the prenatal period or shortly before the operation is due. If the patient be informed that, while she may be cognizant of her operation, any pain will probably be comparable with that occurring during the first hour of labor and that she may rest assured that, should the pain become unbearable the anesthetist is always at hand prepared to administer nitrous oxide or cyclopropane if necessary, she will approach her ordeal with a definite degree of confidence in her knowledge of what is to come.

After proper preparation the patient is brought to the anesthesia room and placed upon the operating table with a pillow under the lumbar spine for greater comfort and, when she is completely arranged, morphine sulfate, gr. $\frac{1}{6}$ and

scopalimine hydrobromide, 1/150 are administered hypodermically. The room is darkened and a nurse sits with the woman until she falls asleep, which usually occurs within fifteen minutes. Thirty minutes after the hypodermic the woman, her eyes lightly covered, is wheeled into the operating room where all is in readiness.

Skin preparation consists of lightly painting the abdomen with iodine and alcohol, after draping the midline is infiltrated with ½ per cent novocaine solution down to the peritoneum. The amount used rarely exceeds 25 cc., 40 cc. being a maximum. A midline incision from the umbilicus downward about 14 cm. is then made, the peritoneum infiltrated and incised. It is most unusual to have the patient complain during the abdominal incision. A No. 2 chromic catgut suture is then introduced at the upper angle of the incision, passing through fascia, muscle and peritoneum then passing into the uterine muscle and out on the opposite side. This suture is tightly tied, the ends held by a hemostat. A similar suture is placed at the lower angle of the incision just at the point of attachment of the vesical fold of the peritoneum. By this means the uterus is anchored to the abdominal incision, and the abdominal walls closely approximate the sides of the uterus. Intestines and omentum are not seen and there is little or no spill of blood and amniotic fluid. Packing is not used. A semilunar incision through the uterine serosa is then made, beginning and ending at the upper and lower sutures and with its convexity toward the operator. A peritoneal flap is very easily turned back by grasping the middle of the incision with an Allis forceps and with a few snips of scissors or simply blunt dissection the flap is turned back until the uterine muscle immediately underlying it is exposed. The uterine wall is then carefully incised for a distance of 2 or 3 cm., until a pouch of membrane bulges through the opening. A gauze pad is laid about the bulging membrane and with trocar and suction apparatus the liquor amnii is drained away. The field being dry, the uterine incision is lengthened, usually from the upper to the lower suture, either by cutting with scissors or, as is preferable, by tearing the fibers apart with the fingers. It is remarkable to note the approximation of the uterine walls upon the completion of the operation when the uterus has been opened by tearing the fibers. This is because the uterine muscle fibers are not severed but merely displaced and pulled apart and tend to readjust themselves as soon as uterine contractions begin. One cc. of pituitrin is given at the beginning of the uterine incision and the baby is withdrawn by breech extraction. Hemorrhage from the uterine wall is ordinarily negligible but if sinuses bleed freely they may be clamped with T hemostats covered with rubber tubing. The usual time for the separation of the placenta is permitted and this organ generally bulges up into the uterine wound in from five to ten minutes after the extraction of the baby. Should this not be the case, the placenta may be separated in the ordinary manner. The empty uterus is then closed by two layers of interrupted or continuous catgut sutures, depending upon the predeliction of the surgeon; and finally the peritoneal flap, which now extends far beyond its original area, is utilized to cover the suture line in the uterus, being attached by a continuous suture of No. 00 catgut. In order to close the abdomen without permitting intestines or omentum to protrude into the wound, the lower suture attaching the uterus to the abdominal wall is cut first and the parietal peritoneum closed by a continuous suture until the upper attachment is reached. This is then cut and the closure of the peritoneum and the rest of the abdominal wall completed. Should it be desired to sterilize the woman, the lower suture is cut, the uterus gently rotated upon the upper suture until the tube appears and when this structure has been anesthetized by further infiltration, any desired procedure for sterilization may easily be completed.

It has been said earlier in this communication that the writer has no fault to find with the low flap cesarean section but he is convinced that in elective operations it offers no especial advantage over corporeal section and that in frankly infected patients it gives little if any more protection against a spreading peritonitis than does the higher incision, because the peritoneal cavity is equally invaded in both instances. Its greatest field of usefulness lies in its employment in the patient who has undergone several hours of labor under good supervision, but who may be in danger of what is sometimes termed potential infection.

The following is an example of the curious thinking which has led to the widespread opinion that the low flap section is safer and preferable to the low fundal type:

In a special article in the Year Book of Obstetrics and Gynecology for 1940, the late Dr. J. B. De Lee, probably the most enthusiastic proponent of the low section in America, made the following statements. He quoted the statistics of the Chicago Lying-In Hospital 1914 to 1936 in which there were 168 classical sections with eleven deaths (6 per cent) and 1,875 laparotrachelotomies with eighteen deaths (0.96 per cent) and made this comment: "All of the advantages grow out of the position of the opening in the uterus. The lower part of the abdomen stands operation and infection better than any other part; the cervix is an infection buffer," etc.

Here is a categorical statement that the tremendous improvement in mortality of one operation over another lies in the fact that the incision in the favored type lies at a maximum of three inches lower than in the condemned procedure.

Two pages further on in the same article this statement appears:

"In securing such remarkable results with laparotrachelotomy at the Chicago-Lying-In Hospital, credit must be given to two measures. First, a rigid selection of cases. In the last 500 patients there were no suspect infections, and few had had any vaginal examinations. Second, we used local anesthesia in nearly all of the 1,250 cases. Thus we avoided pulmonary complications entirely and, with them, the occasional wound infection and peritonitis which arise by way of the blood stream from the infected lung. Further, we thus reduced the incidence of disturbance in the healing of the abdominal wound. Vomiting after anesthesia puts a strain on the recently placed sutures—some giving way, some tearing the muscle or fascia or fat, leaving dehiscences, hematomas and serous extravasations. General anesthesia also increases the morbidity and the mortality of those diseases for which abdominal delivery may be done, e.g., nephritis, heart disease and tuberculosis. Tympany and stomach disturbances coming from anesthesia are almost unknown after the local infiltration method. Hemorrhage from the wound and from the uterus is less, contraction and involution are much better, and altogether local is a much more physiologic method than general anesthesia."

Obviously, if the second conclusion is true, the first has no weight, and vice versa.

This article is quoted, not to assail the work of Joseph B. De Lee, who was always regarded by the writer with the utmost respect and esteem, but to emphasize the lengths to which enthusiasm and partisanship may lead even in the discussion of dispassionate, scientific problems.

The writer has always been a strong advocate of elective section upon any definite indication but it is an interesting fact that in the clinics under his supervision, in which the average number of deliveries is 1,800 annually, the total number of cesarean sections has never exceeded 2 per cent in any one year and the ten year average is 1.8 per cent, this including neglected clinic cases, and indeed, all sections for whatever reason they have been performed.

It does not follow then, that a belief in the value of this or any other procedure need lead to its injudicious employment. The increasing safety of cesarean sections, whatever type of operation is performed has led to certain abuses which have tended to again discredit the operation, despite the improvement in technic and results.

I refer to the indiscriminate employment of hysterotomy, to satisfy either the desire of the patient to avoid labor or to conserve the time of the obstetrician and the fatigue engendered by attendance upon spontaneous delivery. Although elective cesarean section is one of the safest of operations, it is still far more dangerous to the mother than vaginal delivery and always carries with it certain subsequent risks.

In the clamp method of removing the puerperal uterus, there are no ligatures or sutures used, and this is an important factor in the surgery of this type of infection as there is no foreign material remaining to prolong the infection.

From "Vaginal Hysterectomy" by James William Kennedy and Archibald Donald Campbell (F. A. Davis Company).

POSTOPERATIVE HERNIA

REPORT OF A CASE OF REPAIR WITH FASCIAL SUTURES

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A POSTOPERATIVE hernia may occur in any part of the abdominal wall which has been opened surgically. It undoubtedly has its inception during the healing of the incisional wound. Of the twenty-one cases of postoperative hernia which were admitted to Emergency Hospital during the period from 1935 to 1940, inclusive, the time of the appearance of the hernia was known in thirteen cases. Three of the thirteen patients felt a mass in the wound during convalescence from the primary operation. Three others noticed the appearance of the hernia during the first year following operation. Thus in 46.1 per cent of the cases the hernia was known to have developed within the first postoperative year. Branch[1] reported that in a series of 300 cases of incisional hernia diagnosed at the Peter Brent Brigham Hospital, 139 (46.3 per cent) of the patients had noticed the presence of a mass in the area of the wound during the first ninety days following operation.

The factors which contribute to the development of a postoperative hernia are of four kinds: (1) The presence in the patient of obesity or of poorly nourished tissues at the time of the primary operation; (2) increased intra-abdominal pressure during the postoperative period; (3) infection and drainage of the incisional wound; and (4) certain types of operations.

Obesity is accompanied by an increase of fat in the omentum. An excessive amount of omental fat makes the primary abdominal operation more difficult; and it also, by increasing the contents of the abdomen, subjects the suture line to added tension. Among 100 patients with incisional hernia whose primary operation had been performed at the Peter Brent Brigham Hospital, Branch[1] found that forty-eight were so obese at the time of their primary operation that it was difficult to make a satisfactory closure. In thirteen of these cases there was no factor other than the obesity to explain the occurrence of the hernia. Smith and Masson[2] have reported that among the eighty-four cases of ventral hernia repaired with sutures of fascia lata at the Mayo Clinic during the years 1933 to 1936, inclusive, twenty-five patients weighed more than 200 pounds. Schlesinger[3] is of the opinion that disturbances of the healing process are more often caused by the sutured tissues being in a state of poor nutrition than by any other factor. It is generally agreed that a blood dycrasia, such as the anemias, diabetes, syphilis, nephritis, or carcinoma, constitutes a predisposing condition to the breakdown of the operative wound.

Increased pressure within the abdomen following operation is associated in some cases with the development of incisional hernia. When the wound is in the upper part of the abdomen, pressure and tension are induced by the patient's coughing, vomiting or hiccoughing. Pressure in the lower portion of the abdomen is induced by distention. Bancroft[4] divides postoperative hernias into two groups: those occurring below the umbilicus and those occurring above the umbilicus, those below being caused largely by infection and distention, those above largely by the forcible excursion of the ribs pulling upon the transversalis fascia during the act of coughing or vomiting. Among the 100 cases studied by Branch,[1] there were forty-three patients who had abdominal distention,

persisting for from twenty-four to forty-eight hours or longer, following their primary operation, and twenty-eight who had a postoperative cough, lasting for several days. Branch believes that distention or a postoperative cough causes an increase in the intra-abdominal pressure, which not infrequently breaks the sutures or causes them to tear through the tissues, thus allowing the viscus to protrude between the remaining sutures and further weaken the incisional line.

Table I
PRIMARY OPERATION IN TWENTY-ONE CASES OF POSTOPERATIVE HERNIA

Operation	No. of Cases
Appendectomy	13
Appendix ruptured in 6 cases, necessitating drainage	
Patient obese in 4 cases	
Cholecystectomy	1
Wound infected; patient obese	
Cholecystectomy and gastroenterostomy	1
Drainage	
Perforated peptic ulcer	1
Drainage	
Salpingo-oophorectomy	1
Wound infected; patient obese	
Prostatectomy	1
Laparotomy	1
Abdominal injury	1
Not stated	1

Infection of the operative wound and prolonged drainage are also important etiological factors of incisional hernia. Branch[1] reported that forty-nine of the 100 patients in his series showed evidence of infection; in thirty-three the incision had been drained and later became infected, and in the remaining sixteen the wound was infected extending down to, and in some cases through, the fascia. In fourteen additional cases the operative wound had been drained although there was no evidence of infection. Among the twenty-one cases of postoperative hernia admitted to Emergency Hospital, infection was a factor in eight. The wound was drained in two additional cases. Infection or drainage was, therefore, a factor in 47.6 per cent of the series. In thirteen cases of the series, the primary operation was performed because of appendicitis. In six the appendix was ruptured, necessitating drainage. It is noteworthy that four of the thirteen patients were described as being obese; thus infection, drainage, or obesity was a factor in the development of the postoperative hernia in 77 per cent of the appendicial cases. (Table I.) Miscellaneous data concerning the age, sex, and race of the patients in the series from Emergency Hospital are presented in Table II.

Whether a particular type of operation favors the formation of an incisional hernia

Table II
INCIDENCE OF AGE, SEX, AND COLOR IN TWENTY-ONE CASES OF POSTOPERATIVE HERNIA

Age	
20 to 40 years	7
40 to 60 years	9
60 to 80 years	5
Sex	
Male	12
Female	9
Color	
White	18
Colored	3

is debatable. Answers to a questionnaire which McCauliff[5] sent to a number of surgeons showed that 75 per cent of the ruptured wounds which they reported were associated with a midrectus incision and that most of the remaining 25 per cent followed either a transrectus or a midline incision, nearly all occurring above the umbilicus. None of the surgeons recorded the rupture of a muscle-sliding or muscle-retracting incision. Among the 300 cases of incisional hernia admitted to Peter Brent Brigham Hospital, 45 per cent occurred in the lower midline, 17 per cent in the upper right rectus, 16 per cent in the lower right rectus, 15 per cent at McBurney's point following a muscle-splitting incision, and the remaining 7 per cent at scattered points in the abdominal wall. Branch[1] considered that the ratio of 215 females to 85 males in this series is due to the apparent susceptibility of the wounds in the lower midline to rupture and the frequency of this incision in females.

The repair of an incisional hernia is successfully accomplished in the majority of cases by the use of one of the established

methods of herniotomy, such as the overlapping closure devised by Mayo for the repair of umbilical hernia. In some cases the fascial layers cannot be made to overlap, because they have retracted too widely to be approximated. The ideal procedure of suturing like tissues is impossible when muscle and fascia are bound together by adhesions and cannot be separated. In approximately one-fourth of the cases, the usual methods are inadequate, owing to the thinness of the surrounding muscle and the wide retraction of the fascia having created an extensive defect. With such a defect in the abdominal wall, when it may be impossible to approximate the muscle-fascia edge, plastic devices have to be resorted to.

Gallie and LeMesurier[6] were the first to devise a technic for using strips of autogenous fascia lata as living sutures in the repair of large hernial openings. Their method is briefly as follows: The hernial sac and its contents are treated in the usual manner. If the muscle and fascia surrounding the hernial opening cannot easily be dissected, they are left as a single matted layer. When the margins of the opening can be approximated, the defect is closed by a running suture formed from a quarter-inch strip of fascia lata. A meshwork of fascial sutures are then superimposed over the suture line to re-enforce it. When the margins of the hernial opening cannot be approximated, because of the size of the defect or the tension under which the closure is being made, the edges are drawn together as close as is safe and the remaining defect is filled with a woven meshwork of fascial sutures placed closely enough to prevent the underlying tissues from protruding between them. In reporting their operation in 1923, the authors emphasized three procedures in the successful use of their method: (1) The fascial sutures must be solidly anchored into unyielding tissue, such as healthy muscle or aponeurosis. (2) The fascial sutures must be employed in sufficient quantity to withstand the anticipated strain. (3) When the margins of the hernial opening cannot be drawn together, enough suture material must be used to fill the gap completely so that no crevice remains through which the peritoneum can protrude. The authors recommend that the first layer of fascial sutures be overlaid with other layers, which should be woven into strong tissues well back from the edges of the opening.

In reported series of cases of large inguinal hernias repaired with autogenous fascial sutures, the percentages of recurrences range from 3.6 per cent, in a series of eighty-two cases reported by McCloskey and Lehman,[7] to 7.4 per cent, in a series of fifty-four cases reported by Gray.[8] There is a similar disparity in the reported results obtained in the repair of large ventral hernias. Shelley[9] reported that in a series of 207 cases of repair of incisional hernia which were followed for nine months or longer at St. Lukes Hospital, New York, there was a recurrence rate of 13.0 per cent in the group of twenty-three repaired with fascial sutures, in contrast to a rate of 18.5 per cent recurrence among the 184 repaired by other methods. In the series of 300 cases of incisional hernia which Branch[1] studied, there were fourteen in which narrow strips of transplanted fascia lata were used as running sutures to bridge a large fascial defect. There were three recurrences, making the percentage of recurrence (21.4 per cent) slightly higher than in the group as a whole (19.6 per cent). Smith and Masson,[2] in 1940, summarized the results achieved at the Mayo Clinic during the four-year period from 1933 to 1936, inclusive, when eighty-four ventral hernias were repaired with sutures of fascia lata. These eighty-four hernias were the most difficult out of a total of 299 ventral hernias operated upon at the Mayo Clinic during that period. Sixteen of the eighty-four hernias had been repaired one to five times previously. There were five recurrences among the eighty-four cases repaired with fascial sutures (8.1 per cent). An average of forty-three inches of fascia lata was used. In one case 100 inches of the suture material was used. The

authors stated that most of the recurrences were in those cases in which a comparatively small amount of the fascial sutures had been used, and that they are now inclined to use more suture material than they did formerly.

In the following case of postoperative hernia, I adapted the Gallie technic, modifying the operation in several respects, to repair a particularly large hernial opening. Gallie used quarter-inch strips of fascia lata, which he allowed to roll into a cord-like suture. In the operation reported below, strips of fascia lata one inch wide were used and were held in place by silk sutures. As the margins of the hernial opening could not be approximated, there was no tissue to be re-enforced. The bands which were applied across the opening were the only covering over the defect.

CASE REPORT

The patient, a rather large, well built man, thirty-five years of age, was seen on March 25, 1940. He complained of an incisional hernia on the right side of the abdomen. He gave a history of having been operated upon, elsewhere, three times. The first operation was for a ruptured appendix, which required drainage. The second and third operations were for the repair of the hernia. Each closure had been made with catgut. Following each operation the hernia had recurred. The last operation had been done in 1936.

The physical examination revealed nothing important except the condition of the abdomen, where a definite protrusion was most marked when the patient stood or coughed. The weakness in the fascia was about three inches or more in diameter and about five or six inches in length. Practically no fascial border could be felt on the outer side toward the anterosuperior spine. The patient was advised that it would be necessary to take a fascial transplant from his thigh, and that even then there could be no guarantee of a cure. He accepted these conditions and was admitted to the hospital several days before the operation. The size of his abdomen was reduced by diet and catharsis. Both the abdomen and the left thigh were prepared in advance as in "orthopedic cases."

The patient was operated upon April 8, 1940, under avertin and gas. The two existing scars were excised and the skin and superficial fascia were dissected back to expose the borders of the combined muscle-fascia planes. The weak area of peritoneum and scar tissue was large enough to admit an adult fist. The peritoneum was opened in one place and dense adhesions were found between coils of small intestines and the undersurface. This opening was closed without further disturbing the abdominal contents. The edges of the incision were dissected and freshened. They were then brought together at the corners and sutured with fine black silk, so as to narrow the opening. A transplanted strip of fascia lata, one inch wide and about eighteen inches long, was woven across the opening and its surrounding area of weakened tissues. The strips were held flat and fastened with silk sutures, as shown in Figure 1. As the dissection was extensive and some oozing was anticipated, a Penrose drain was inserted in each end of the wound.

The day after the operation, the patient's temperature was 104.4°F., his pulse was 110 beats per minute, and he began to cough. A large amount of bloody serous fluid drained from the wound. The leucocyte count was 26,000, with the polymorphonuclears 81 per cent. Dr. B. L. Hardin, Jr., who examined the patient, found dullness in the right middle lobe of both lungs. On the second postoperative day, a roentgenogram of the chest showed infiltration in the region of the hilus, on both sides. Examination of the sputum showed pneumococci, type IX. On the sixth day, there was a semipurulent discharge from the wound. When one or two stitches were removed, a great quantity of this same fluid poured out. The outlook for a permanent cure of the hernia seemed very dubious.

The patient left the hospital on the twenty-second postoperative day. The drainage, although diminished, was still considerable. The wound was dressed in the office every other day, and later once a week, for two months. On several occasions, silk sutures were removed by hooking them with a crochet needle. No fascia was ever seen or removed. The patient has been examined at intervals and there has never been any evidence found of a weakening of the sutured area or of a recurrence of the hernia.

The satisfactory result in this case brings up two controversially interesting points: (1) The advantages of using living fascia in the repair of hernias; and (2) the use of nonabsorbable sutures in infected wounds. A discussion of the advantages of using living fascia as sutures in the repair of hernia may well be prefaced by a statement of the conditions under which its use is justifiable. It is indicated, I believe, only where there is a congenital loss of fascia, as in some cases of inguinal hernia, or where there is an acquired and fairly extensive loss of fascia, as in the case which has just been reported.

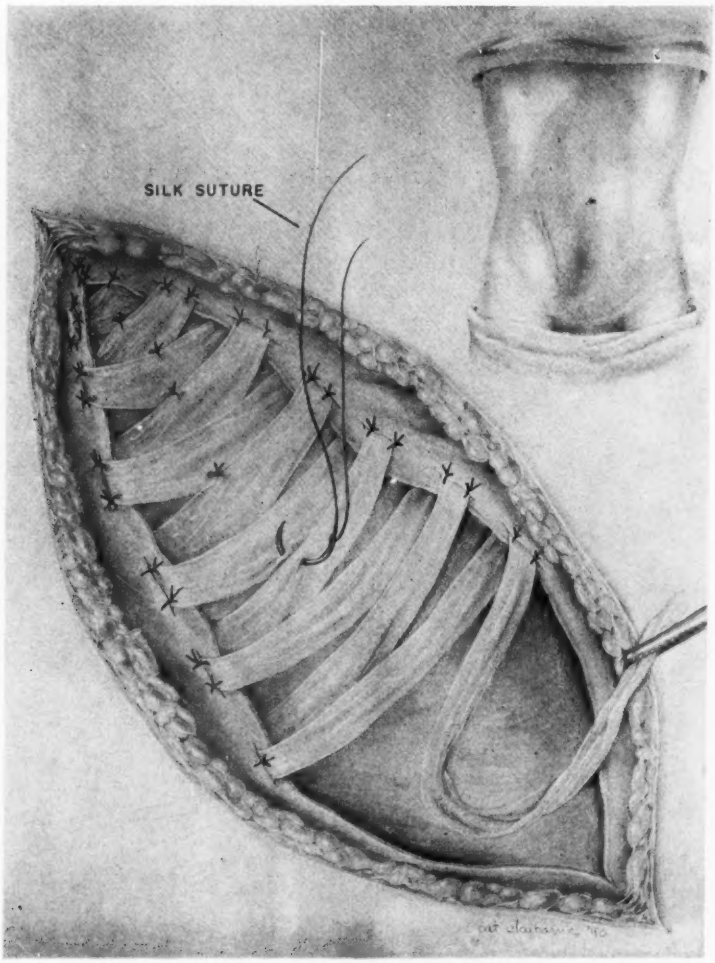

FIG. 1. Shows cross lacing of the wound with a broad strip of fascia without tension. The strips were approximated closer than shown in the drawing.

The technic of Gallie and LeMesurier[6] was based upon extensive animal experiments which demonstrated the following points: (1) In the healing of incisions made in the fascia and aponeurosis of the experimental animals, the new connective tissue over the line of suture was continuous with the areolar membrane normally on the surface of those structures. There was no evidence of any inflammatory reaction in the cells of the fascia or aponeurosis themselves and no indication that they contributed to the production of the scar tissue. Histologically, the union between the cut edges of the fascia and of the aponeurosis appeared to be weaker than the surrounding tissues. When specimens were examined after the lapse of months, it was almost always found that in those specimens in which the edges of the incision had been sutured under tension, or in which the

line of sutures had subsequently been subjected to strain, the edges of the wound had separated, owing to the stretching of the scar. (2) When fascial transplants were sutured to fascia, it was found that the fibers of the fascia did not proliferate during the process of healing. The transplant remained exactly as it had been at operation. It was held in position only by a thin areolar membrane derived from the areolar fibers of the neighboring tissues. When the normal activities of the animal produced strain on the line of healing, the edges of the transplant and the edges of the defect separated just as had the edges of the simple incised wounds. (3) When quarter-inch strips of fascia were used experimentally to bridge a gap of half an inch and were later recovered, it was found that even after two years the fascial sutures remained practically unchanged and that their tensile strength remained unimpaired. No stretching or contraction had occurred. On the basis of their experiments, Gallie and LeMesurier concluded that fascial sutures are superior to patch transplants in the repair of large hernial openings because the living suture depends for its strength not on scar tissue but on the mechanical grip with which it holds the edges of the wound. When used clinically, the autogenous fascial suture does not appear to slough off to any extent in the presence of infection. It also does not seem to stretch and thin out under tension to the degree that scar tissue does.

It has been shown repeatedly that the incidence of hernia is higher in infected wounds than it is in wounds which heal per primam. It is also fairly well established that infection occurs more frequently in wounds sutured with catgut than in those closed with silk. Elkin[10] found that in a series of 1,787 surgical cases the incidence of infection was 2.1 per cent in wounds sutured with silk and 9.4 in wounds closed with catgut. In a series of potentially infected cases he found that definite infection developed in 7.9 per cent of the wounds sutured with silk, compared to 21.4 per cent in which catgut was used.

The exact cause for the more frequent occurrence of hernia following the use of an absorbable suture than of a nonabsorbable suture is not altogether plain. However, it has been shown by Howes and Harvey[11] and others that catgut is absorbed at different intervals in different individuals and under different conditions. In the presence of infection, the absorption is frequently accelerated. Fibroplasia progresses more slowly when catgut is used than when silk is employed; hence healing is delayed. The complete absorption of catgut requires considerable phagocytosis and tissue reaction. This process also delays healing. One has only to look at a wound in which silk alone has been used and compared it to one in which catgut has been employed to see the difference in the healing process. In the former there is very little sign of inflammation, as evidenced by heat, redness, and swelling, whereas in the latter all three are present.

Before leaving the question of sutures, I should like to quote from Ochsner.[12] In 1939, he stated: "I began using silk in persons who were debilitated, such as patients with carcinoma. I now use silk much more extensively. I feel that silk is particularly indicated in cases of infection. Ordinarily one would think of not using silk in the presence of an infection, but I believe that in cases in which healing is delayed and in which rupture is likely to occur its use is especially indicated. If one does use silk, let me reiterate the points which Professor Halsted emphasized many years ago. One must use fine silk; only interrupted sutures are to be used and the knots cut short; and only small bits of the tissue are caught in the stitch. In spite of the teaching of Halstead and Whipple concerning the proper use of silk, most surgeons when beginning to use silk use it incorrectly and therefore obtain undesirable results. If one will use interrupted silk sutures, it is surprising how many frankly contaminated wounds and infected wounds will heal with-

out discharge. It is continuous silk in the presence of infection which is particularly dangerous." In a more recent communication, Meade and Ochsner[13] proposed cotton as a suture material which is pliable, readily sterilized, nonirritating, and, when used as recommended, sufficiently strong for most surgical procedures. Their proposal was based upon experiments which demonstrated the relative loss of tensile strength, amount of tissue reaction, time of wound healing, and extent of the bacteriology associated with sutures of catgut, silk, linen and cotton. They reported having used cotton sutures in ninety-one surgical cases, in eighty-eight of which primary healing took place.

There are certain precautionary measures which may be carried out in cases of abdominal surgery to lessen the possibility of an incisional hernia developing or recurring. In the preoperative preparation of the patient, excess weight should be reduced; the undernourished patient should be given proper food; colds and other infectious processes should be cleared up, if possible; and the general health of the patient should be improved. Following operation, the patient should remain at rest in bed for an adequate period. If he is inclined to be obese, he should not be permitted to gain weight. The food intake by mouth should be limited. To prevent abdominal distention or vomiting, a Wangensteen suction tube, inserted through the patient's nose, should be employed for two or three days after the operation. Singleton and Blocker,[14] who reviewed 9,000 consecutive cases of abdominal surgery while studying the problem of wound disruption and postoperative hernia, were convinced that gastric suction would prevent postoperative vomiting and distention if the measure were effectively and routinely used during and after operation in all cases of abdominal surgery. Patients usually strain while becoming accustomed to the presence of a suction tube. To protect the wound against the effects of undue abdominal strain, a Skultus bandage, or binder, should be applied before the tube is placed in position. As prolonged drainage appears to be a predisposing factor in the development of hernia, drainage should be instituted only when it is definitely indicated, and the tubes should be removed as soon as practicable.

SUMMARY

1. The predisposing factors of postoperative hernia have been discussed. Obesity, abdominal distention, coughing, and vomiting, by subjecting the line of suture to increased tension, may cause a breakdown of the incisional wound; infection and prolonged drainage may weaken and disrupt the wound, thus permitting the formation of a hernia.

2. A review of twenty-one cases of postoperative hernia admitted to Emergency Hospital shows that infection or drainage was a factor in 47.6 per cent of the series. Infection, drainage, or obesity was a factor in 77 per cent of the thirteen cases in which the primary operation was an appendectomy.

3. The Gallie technic of using living sutures of fascia lata has been examined. The operative results in representative published series of hernial repair by the use of fascial sutures have been reviewed.

4. A case has been reported in which a modification of the Gallie technic was used in the repair of a large hernial opening.

5. Emphasis has been placed upon the superiority of nonabsorbable sutures in infected wounds and the advantages of using fascial sutures when the edges of the wound are widely retracted.

6. Precautionary measures to guard against the development of hernia have been considered.

REFERENCES

1. Branch, Charles D. Incisional hernia: analysis of three hundred cases. *New England J. Med.*, 211: 949–952, 1934.
2. Smith, Caleb H. and Masson, James C. Results of the repair of ventral hernias with sutures of fascia lata. Review of eighty-five hernias. *Surgery*, 7: 204–211, 1940.
3. Schlesinger, Arthur. Die Operation ubergrosser Bauchnarbenbruche. *Zentralbl. f. Chir.*, 59: 1151–1155, 1932.

4. Bancroft, Frederic W. Hernia. *Pennsylvania M. J.*, 40: 63–70, 1936.
5. McCauliff, Guy T. Rupture of wounds following abdominal operations. *J. Iowa M. Soc.*, 23: 347–351, 1933.
6. Gallie, William E. and LeMesurier, A. B. The use of living sutures in operative surgery. *Canad. M. A. J.*, 11: 504–513, 1921; Living sutures in the treatment of hernia. Ibid, 13: 469–480, 1923.
7. McCloskey, John F. and Lehman, James A. Living fascial sutures in the repair of large inguinal herniae. *Ann. Surg.*, 111: 610–615, 1940.
8. Gray, W. The operative treatment of inguinal hernia. Results obtained in adult males by the fascial suture technique. *Brit. M. J.*, 1: 568, 1940.
9. Shelley, Harold J. Ventral hernias. A study of 550 hernias and 458 repairs. *Southb. Surg.*, 9: 617–656, 1940.
10. Elkin, Daniel C. Wound infection: a comparison of silk and catgut sutures. *Ann. Surg.*, 112: 280–283, 1940.
11. Howes, E. L. and Harvey, S. C. Tissue response to catgut absorption, silk and wound healing, correlation to tensile strength. *Internat. J. Med. & Surg.*, 43: 225–228, 1930.
12. Ochsner, Alton. Discussion: The problem of disruption of abdominal wounds and post-operative hernia. *J. A. M. A.*, 112: 126–127, 1939.
13. Meade, W. H. and Ochsner, Alton. The relative value of catgut, silk, linen, and cotton as suture materials. *Surgery*, 7: 485–514, 1940.
14. Singleton, A. O. and Blocker, T. G., Jr. The problem of disruption of abdominal wounds and postoperative hernia. A review of 9,000 consecutive abdominal incisions. *J. A. M. A.*, 112: 122–126, 1939.

In Pott's fracture, the ankle joint appears widened. The foot is everted. Great swelling appears promptly. Point tenderness is felt over the internal malleolus and over the fibula just above the malleolus.
From "A Manual of the Treatment of Fractures" by John A. Caldwell (Charles C. Thomas).

ADDITIONAL EXPERIENCES WITH SPOOL COTTON AS A SUTURE MATERIAL*

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AN ideal suture material from the surgeon's point of view would be one that induces little tissue reaction, is absolutely sterile and maintains its tensile strength while embedded in tissue. Our experiences in Cook County Hospital during the past two years have convinced us that cotton thread meets the above prerequisites satisfactorily and is superior to catgut, linen or silk. Since cotton is easily sterilized, inexpensive, portable and readily available, it will undoubtedly make an ideal war-time suture material. We have used cotton as the suture of choice in over 400 major and minor surgical procedures with excellent end results.

Cotton is not a new suture material. It was used as early as 500 B.C. by Susruta.[1] Recently, however, it has been popularized by Meade and Ochsner,[2] Meade and Long,[3] Taylor,[4] and Thorek,[5] all of whom report excellent results with cotton thread. To appreciate the advantages of cotton a review of the dynamics of normal wound healing is essential. All that can be expected of a suture is that it will keep the tissues approximated; the process of healing is a natural phenomenon and occurs in spite of the suture used. The approximation of the wound edges is immediately followed by an exudation of serum which tends to glue the tissues together. This constitutes the first phase of wound healing and is followed by the second phase known as fibroplasia. Any factor increasing the exudation phase will accordingly delay the onset of fibroplasia and prolong healing. Catgut heals by "wet healing," whereas most nonabsorbable suture materials are associated with "dry healing." "Wet healing" merely refers to the prolongation of the serum exudate brought about by the tissue reaction. Cotton, unlike catgut and other suture materials, appears to be least irritating to the tissues and heals by "dry healing." This phenomenon of exudation associated with the various suture materials has recently been clearly demonstrated by Farris[6] who placed catgut, silk and cotton into the anterior chamber of a rabbit's eye. After remaining *in situ* for fourteen days, the catgut produced a marked opacity of the anterior chamber, practically blinding the animal. Although silk produced a slight reaction it was more irritating then cotton and showed a tendency for its fibers to untwist. Cotton, however, was associated with the least irritation and showed little tendency to untwist and fray at the edges.

Cotton has other qualities which make it superior to silk or linen. Cotton is a vegetable fiber which has a natural tendency to twist. Fraying of cotton does not occur as with linen or silk, thus fascilitating its handling, threading, etc. Meade and Ochsner believe this twisting of fibers associated with cotton prevents the ingrowth of leukocytes and infected granulations into the substance of the suture material. This may be the explanation for the absence of draining sinuses with cotton and this not infrequently occurs with silk, especially when used in infected cases. (Figs. 1, 2 and 3.)

The wound is not healed until fibroplasia is completed. During the ten to twelve days usually required for its completion, the approximation of the wound edges is dependent primarily upon the

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tensile strength of the suture material. Meade and Ochsner have shown by animal experimentation that comparison of cotton, silk, linen, and catgut revealed that cotton was unexcelled in maintaining its tensile strength *in vivo*. After the sutures were embedded in tissues for ten days, cotton maintained its tensile strength at 100 per cent, whereas silk, linen and catgut had a tensile strength loss of 25, 40, and 70 per cent, respectively. The pliability of cotton and its increased coefficient of friction makes handling and knot tying easier and more secure.

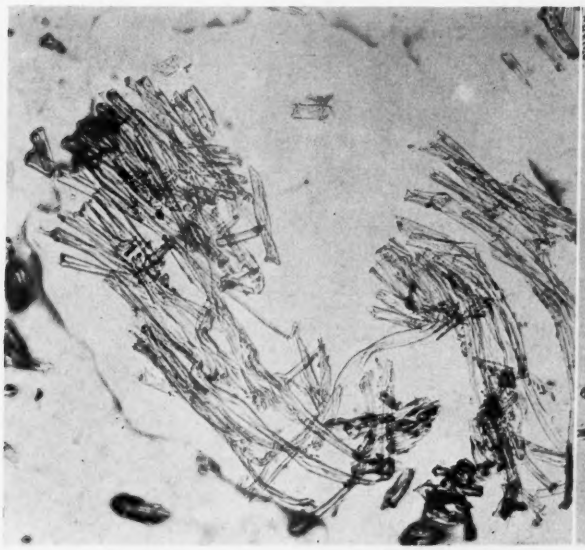

Fig. 1. Quilting cotton magnified 92 times. The fibrils have a natural tendency to twist.

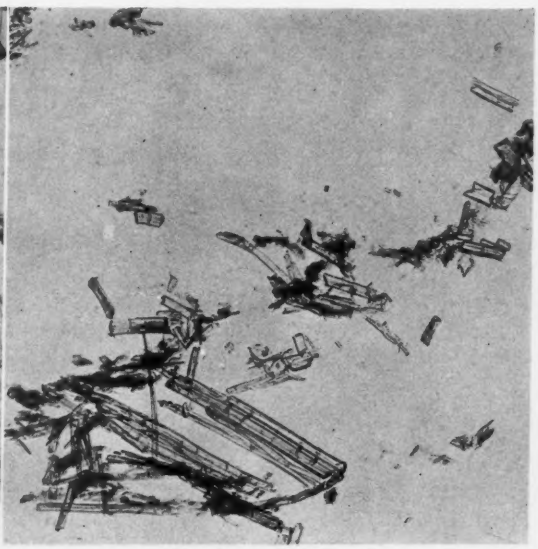

Fig. 2. Pagenstecher linen magnified 92 times. The fibrils appear straight and parallel.

Sterilization of cotton thread can be accomplished simply by autoclaving for ten minutes at 15 pounds pressure or boiled for twenty minutes without diminishing its tensile strength. Since cotton contracts when heated it should not be sterilized on a rigid spool. Formerly we wrapped the thread on a flexible rubber tube; the compressibility of the rubber would prevent breaking or loss of tensile strength of the cotton fibrils. Recently, however, we have had satisfactory results by cutting the cotton thread into the desired lengths, attaching them to a cardboard with a paper clip, and autoclaving for ten minutes.

Various sizes of cotton are available, but for practical purposes we have used only three, Nos. 100, 50, (quilting) and 24. No. 100 is a very fine cotton thread and must be handled gently. It is used for ligation of small vessels and in subcutaneous suturing. Quilting corresponding to No. 50 is the next largest size used and is utilized for closure of peritoneum and skin, seromuscular and purse-string sutures in bowel surgery. No. 24 is the largest size used and with it we repair the fascia in all abdominal incisions and herniorrhaphies, as well as ligation of larger arteries such as the popliteal, superior thyroids, uterine, etc. If for some reason a heavier suture is desirable, we utilize No. 24 doubled.

Our excellent result with cotton can be attributed to the teachings of Halsted,[7] who emphasized that nonabsorbable sutures, (he was primarily referring to silk) should be used interrupted, using only very fine material, and avoiding strangulation of tissue as well as dead space. Although he stressed that absorbable and nonabsorbable sutures should not be used in the same wound, we have found no ill effects when we would occasionally suture peritoneum with continuous catgut whenever as peedy closure was advisable.

Regardless of the suture material used there are other important factors influenc-

ing wound healing, such as nutrition of patient, hypoprotenemia, vitamin c content of blood, local blood supply, presence of infection, skill of surgeon, etc. As pointed out by one of us (P. T.) in a previous communication, tissues requiring approximation under tension do not belong together. Cotton thread will not tolerate rough handling, therefore, by its constant use the surgeon will further the development of a nontraumatic technic. Avoiding tissue strangulation, catching only the vessel and not its adjacent fat, using finer suture material, cutting directly on the knot, and accurate hemostasis will soon result in a greater incidence of primary wound healing.

Fig. 3. Black silk magnified 92 times. The fibrils appear rigid and straight.

Other properties of cotton make it the ideal war-time suture. Sparkman and Williams,[8] in a recent communication have demonstrated that cotton has proved its worth during actual United States Army maneuvers in the fall of 1941. Using cotton under conditions simulating actual warfare, (appendectomies performed on soldiers in tents without modern methods of insect and fly control) their incidence of infection in 120 cases was 0.83 per cent. Their conclusions were in accord with ours, that cotton can be employed safely in clean, contaminated or infected wounds.

Cotton is readily sterilized, portable, and above all is very inexpensive. Foss[9] has compared the cost of cotton, silk and catgut as used in 647 operations. The average operation required about 25 yards of cotton or silk, and 6 tubes of catgut. The cost of cotton was 1¼ cents, silk 93 cents, and catgut $1.16 per operation. Approximately ninety operations can be performed with cotton for the same cost of one operation using catgut.

Our series at present, over 400 cases, includes such cases as thyroidectomy, mastectomy, gastric resections, gastroenterostomy, Mickulicz procedures for large bowel neoplasm, appendectomy, pelvic surgery, cholecystectomy, common

duct surgery, herniorrhaphies, hydrocele, skin grafts, nerve and tendon repairs, leg amputations, and many minor surgical procedures as repair of fresh lacerations, vein ligations, etc. We have classified all our cases into clean and contaminated wounds; our incidence of infections were less than 4 per cent. Since this includes perforated appendicies and infected diabetic gangrenes, the incidence of infection is exceedingly low. We have intentionally used cotton in grossly contaminated wounds to determine whether cotton like silk would produce a chronic draining sinus. To date no such sinuses have developed. We have especially been impressed with the high incidence of primary union in cases of supracondylar amputations for spreading diabetic gangrene. Prior to the use of cotton, draining sinuses, osteomyelitis of the stump, and necrotic suture lines were not infrequent in our diabetic unit. During the past two years with the adoption of cotton technic these latter complications have indeed become a rarity; of the last twenty leg amputations, two infected wounds resulted. It is interesting to note that in each infected case catgut and silk were the sutures used.

The interrupted suture technic was used in all instances with few exceptions. Continuous No. 00 catgut was used for peritonealization of gallbladder bed, cervical stump following hysterectomy, and for peritoneal closure whenever speed was necessary and for the mucosal suture in intestinal anastomoses. We still believe that in gastrointestinal anastomoses, hemostasis is best accomplished with a continuous mucosal catgut No. 00 suture. We have, however, used quilting cotton as a through-and-through suture on the mucous membrane side in a cholecystogastrostomy and also in a case of Meckel's diverticulum in which the base of the diverticulum was very wide and had to be sutured by means of a two-layer closure. No ill effects were noticed.

At present we are conducting a series of cases with sulfanilamide and cotton used together. Our results will be reported in a later communication.

CONCLUSION

1. Further experiences with spool cotton as a suture material are reported.

2. Its availability, economy and ease of sterilization makes it an ideal war-time suture.

3. It can be used in grossly contaminated wounds without danger of sinus formation.

4. The routine use of fine cotton will further the development of better surgical technic.

5. Cotton appears to be superior to catgut, silk and linen both experimently and clinically.

REFERENCES

1. Melle, G. J. Early history of the ligature. *South African Med. J.*, 8: 290, 1934.
2. Meade, Wm. H. and Ochsner, Alton. Spool cotton as a suture material. *J. A. M. A.*, 113: 2230–2231, 1939.
3. Meade, W. H. and Long, Carrol H. The use of cotton as a suture material. *J. A. M. A.*, 117: 2140–2143, 1941.
4. Taylor, K. P. A. Single unit cotton thread surgical technique. *Smith Surg.*, 10: 125, 131, 1941.
5. Thorek, P. Experiences with spool cotton as a suture material. *Am. J. Surg.*, 55: 118–120, 1942.
6. Farris, John M. In discussion of Drs. Meade and Longs paper. *J. A. M. A.*, 117, 2141, 2142, 1941.
7. Halsted, W. S. The employment of fine silk in preference to catgut and the advantages of transfixing tissues and vessels in controlling hemorrhage. *J. A. M. A.*, 60: 1119, 1913.
8. Sparkman, Robert S. and Williams, William H. *Surgery*, 11: 698, 1942.
9. Foss, Harold. In discussion on Estes, W. L. Jr. End results in repair of inguinal hernia by a fascia to fascia rectus sheath closure. *Ann. Surg.*, 113: 838, 1941.

GALLSTONE ILEUS*

RECURRENCE IN ONE CASE

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WE believe the three cases presented in this paper are of unusual interest in several respects. All three cases occurred in a 140-bed hospital within a period of approximately two years. The preoperative diagnosis was suggested in the one case, and was made with certainty by the aid of *x*-ray in the others. One patient had a recurrence of gallstone ileus within the first week of convalescence which was likewise diagnosed and treated successfully surgically.

The recurrence of the obstruction in the first case might have been avoided if a thorough search of the entire small bowel had been made at the first operation. However, the presence of the second stone was unsuspected because at the first exploratory laparotomy the intestinal loop proximal to the stone was collapsed.

INCIDENCE

In a report of 500,000 operative cases by Martin[1] there were only sixteen cases of intestinal obstruction due to gallstones. In 1935, Boreman and Rigler[2] reported eleven cases of gallstone obstruction in 19,474 autopsies at the University of Minnesota Hospital. Judd,[3] in 153 cases of internal biliary fistula operated upon at the Mayo Clinic reported that in 1925 there was only one case of gallstone ileus. However, in 1938, Wakefield, Vickers and Walters[4] reported ten cases of gallstone ileus in the same clinic. In Table 1, 12,153 cases of intestinal obstruction are summarized with 208 due to gallstones, i.e., 1.7 per cent. Balch[6] states that women are much more prone to this obstruction than men, in the proportion of 15 to 1, whereas the incidence of gallstones is about 3 to 1 in favor of women.

TABLE 1

Total Obstructions	Gallstone Obstructions	Percentage	Authority
3,625	47	1.3	Vick[5] (Symposium on Intestinal Obstruction, 1932)
1,655	28	1.7	Souttar[5] (Symposium on Intestinal Obstruction, 1925)
505	2	0.4	Meyer and Spinack[5] 1934
295	23	7.8	Osler[5] 1900
1,152	41	3.5	Leichtenstern[5]
360	8	2.2	Barnard[5] 1902
669	14	2.1	Barnard[5] 1905
502	10	2.0	Balch[5] (M. G. H. 1898–1932)
3,064	28	0.9	Bennett[7]
179	4	2.2	Powers[18]
147	3	2.	(Hosp. for Women of Md. 1929–1941)
12,153	208	1.7	

DIAGNOSIS

Pybus[9] reported a case in which he could feel a hard object, presumably a gallstone, in the right iliac fossa before operation; this finding is much too rare to be useful in diagnosis. Although the diagnosis may be strongly suspected because of gallbladder disease associated with a bizarre type of intestinal obstruction, a conclusive diagnosis can scarcely be made preoperatively without the aid of *x*-ray. Rigler[14] mentions definite preoperative diagnosis by *x*-ray in only twenty-four cases reported up to November 1941. The most helpful sign

* From the Surgical Service of the Hospital for the Women of Maryland, Baltimore.

leading to diagnosis from *x*-ray is probably gas or opaque material in the biliary tree. This indicates probable internal biliary fistula. A stone in a dilated intestine unfortunately is not often visualized, but when seen is almost conclusive of gallstone ileus. If a biliary fistula can be demonstrated in the presence of intestinal obstruction, the diagnosis is fairly certain. (Fig. 4.) In Figures 1, 2 and 5 the diagnosis is certain.

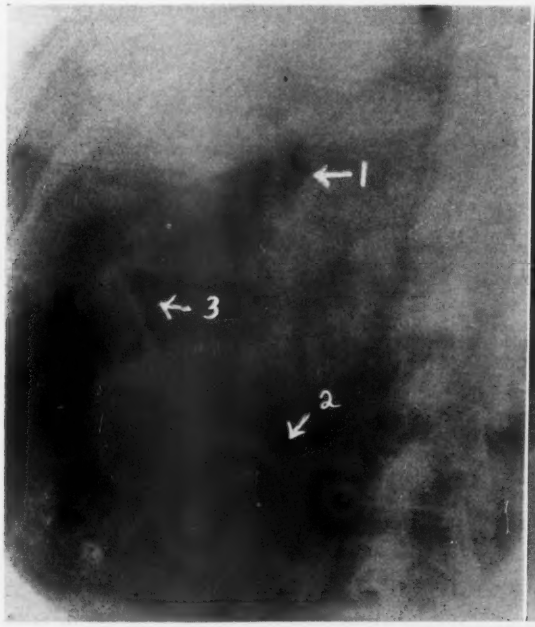

Fig. 1. Case 1. *X*-ray in routine gallbladder series disclosed (1) gas in biliary tree; (2) dilated small bowel; (3) stone within lumen of small bowel; (4) nonfilling gallbladder. The positive diagnosis was biliary fistula, high intestinal obstruction and gallstone ileus. This stone was proved to consist of cholesterol by chemical analysis.

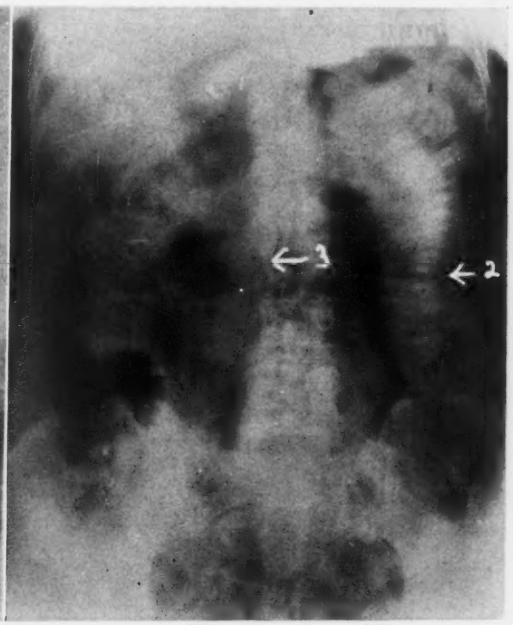

Fig. 2. Case 1. Flat plate of abdomen taken on the eighth postoperative day because of recurrence of obstructive symptoms. The findings were (1) gas in biliary tree; (2) dilated small bowel; (3) stone in lumen of small bowel. The positive diagnosis was recurrence of gallstone ileus on the eighth postoperative day. This stone was proved to consist of cholesterol by chemical analysis.

MULTIPLE STONES

Holz[8] described a case in which a stone as large as a hen's egg was removed from the sigmoid. One large facet faced upward and he presumed another stone to be present higher. The second stone with the opposite facet was found adhering to the duodenum and obstructing it. This was removed along with the gallbladder, and the patient made an uneventful recovery. Pybus[9] reported a case in which the obstruction was relieved by ileotomy and removal of the gallstone, but on examination of the gallbladder two additional stones were found. The gallbladder was separated from the duodenum, the opening in the latter closed and the two stones removed from the gallbladder which was simply drained. This patient likewise recovered. Moschowitz[10] presented a case of gallstone ileus relieved by ileotomy, and enteroenterostomy because of postoperative narrowing of the lumen of the ileum. On the twenty-sixth postoperative day a large facetted stone was manually removed from the rectum and the patient was discharged well. Drew[13] reports a case in which the stones were found so impacted in the jejunum as to necessitate two separate openings into the bowel for their removal. These cases and many others[4] indicate the presence of multiple stones without recurrence of serious obstruction. Recurrent ileus is much less common than the findings of multiple stones.

RECURRENT GALLSTONE ILEUS

Downs[10] recalled a case in which he removed one stone in operation only to have a recurrence of obstruction forty-eight hours later. On re-opening the wound a second stone was found impacted in the gut at the point where the sutures had been inserted. Pybus[9] reported a case of recurrent obstruction four days after removal of a large stone from the terminal ileum. The symptoms were thought to be due to peritonitis and no further operation was performed. At autopsy, "General Peritonitis was found due to a small perforation of the ileum above a stone impacted about 5 feet above the ileo-cecal valve and about two feet above the incision for the removal of the first stone. Some distance above this stone a second was found impacted with similar perforations. There was a fistula between the gallbladder and the duodenum, but the former had completely discharged its contents, three stones in all." Holz[8] mentions five cases of recurrent gallstone ileus, in three of these the second stone was removed during the immediate convalescence from the first operation. Van Ravenswaay[11] reported a case in which the obstruction occurred ten days after removing the first stone from the small intestine; rectal examination revealed another stone high up in the rectum. After manual removal, her recovery was uneventful. Schwarke[12] reported recurrence in a sixty-nine-year old woman who recovered after her second operation. Wakeley[5] described an obstructive case relieved for eighteen hours by removal of the stone manually from the rectum. After this time a second stone was removed from the ileum and the patient died later of paralytic ileus. At autopsy a cholecyst-duodenal fistula was demonstrated. Hinchey[7] reported the case of a patient in 1940 who expelled a large stone with two facets following a barium enema; a second stone was passed a week later. She was then admitted with an obstruction and an *x*-ray diagnosis of high intestinal obstruction due to impacted gallstone was made before operation. At operation a stone was removed from the jejunum without searching for an additional stone. She was re-admitted three months later with similar symptoms, the same *x*-ray diagnosis was made preoperatively and a second stone was removed from the jejunum. The convalescence was stormy but she recovered.

FIG. 3. Case 1. *X*-ray taken one month after first ileotomy. It clearly demonstrates biliary tree and indicates the persistence of the internal biliary fistula for at least one month. There is no evidence of obstruction or stone anywhere.

MORTALITY

Balch[6] reported seventeen cases of gallstone ileus; of these ten patients died. Wakeley[5] reported only three deaths in eleven cases. Souttar[15] reported twenty-eight cases of gallstone ileus with fourteen deaths, Vick,[16] forty-seven cases with a mortality of 70 per cent, and Courvoisar,[17] 125 cases with a mortality of 44 per cent. In our series, one of three patients died.

CASE REPORTS

CASE 1. Mrs. Z. H., sixty-three years of age was admitted November 17, 1941. Six days

previous to this admission there was a sudden onset of upper right quadrant pain, radiating to the right scapula, associated with nausea, vomiting and intermittent abdominal cramps. There were no jaundice, chills or noticeable fever. The patient had complained for years of intolerance to fatty foods and excessive eructation and flatulence. She had had previous attacks of right upper quadrant pain as far back as twenty years before, and had one severe attack similar to the present one year ago. Her bowels were usually quite regular with no passage of blood, pus and no change of bowel habits up to her admission.

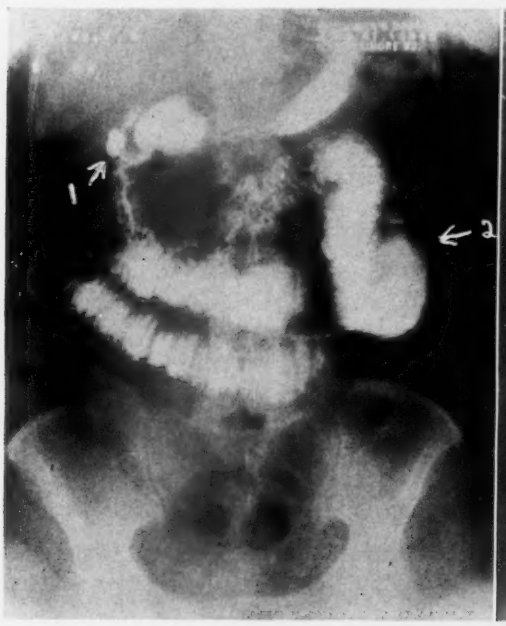

Fig. 4. Case 11. Routine three-hour plate in gastrointestinal series. Findings were (1) barium in biliary tree and atrophic gallbladder; (2) dilated small bowel. A diagnosis of biliary fistula, high intestinal obstruction and probably gallstone ileus was made.

Fig. 5. Case 11. Routine six-hour plate in same gastrointestinal series as in Figure 4. Findings same as in Figure 4 with visualization of gallstone within the bowel at site of obstruction. The diagnosis was certain for gallstone ileus.

Physical examination showed her temperature to be 99.6°C., pulse 68 respiration 22, blood pressure 137/88, hemoglobin 90 per cent, white blood count 11,000, icteric index 10, and blood sugar 135. The patient appeared more acutely ill than her chart would indicate. Her mucous membranes were dry, her abdomen was soft, lungs were clear, and the heart not enlarged; it was regular in rhythm. There was definite epigastric and upper right quadrant pain on pressure with spasm of the right rectus muscle. There were no palpable abdominal masses, no previous operative scar and no evidence of a hernia. Pelvic rectal examination was negative.

Supportive treatment of i.v. glucose was started and on the second night the patient retained most of the gallbladder dye in spite of the persistent nausea and some vomiting. *X*-ray examination revealed a nonfilling gallbladder with dilated duodenum and jejunum, gas in the biliary tree and one circular opacity within the lumen of the jejunum that was interpreted to be a gallstone. (Fig. 1.) After ingestion of barium by mouth the stomach and duodenum appeared normal but barium filled the biliary tree. The stone was not seen in these films but the diagnosis remained gallstone ileus.

Since the patient was getting progressively weaker, immediate operation was undertaken to remove the stone. This was done on November 19, 1941. Under sodium pentothal anesthesia (1.25 Gm.) the abdomen was easily entered through the upper right rectus approach. Dilated loops of small bowel were immediately encountered and on withdrawing approximately two feet of this dilated intestine, the point of obstruction was located beyond which there was a striking contrast of collapsed intestine. A hard object could be palpated, presumably a gallstone of more than one inch in

diameter. Without further exploration, the stone was removed via a longitudinal incision, after pushing it down into healthy bowel, a distance of about three inches. The opening was closed longitudinally with No. 00 chromic catgut, reinforced with fine black silk. Although the lumen appeared constricted to approximately two-thirds the normal diameter, it admitted the forefinger. The gallbladder was now felt for but was so involved with dense adhesions that it could not be definitely identified. The small intestine above the operative site was carefully palpated for an additional stone but none was found. The abdomen was then closed in layers, 5 Gm. of powdered sulfathiazole being sprinkled in the wound. Toward the end of the operation the patient's pulse became rapid and irregular; it was thought that she had auricular fibrillation.

FIG. 6. Case 11. Routine twenty-four-hour plate shows most of the barium in the small bowel but there is a small amount beyond in the colon. The stone can still be seen at the site of obstruction and a Miller-Abbott tube has been inserted into the jejunum.

The patient's convalescence was uneventful to her sixth postoperative day. An electrocardiogram had confirmed auricular fibrillation and suggested myocardial damage but her pulse had become for the most part regular. On the sixth postoperative day she vomited a large amount of foul-smelling, yellow material. There was no abdominal distention and no abdominal cramps; the wound was perfectly clean and she was afebrile.

On the eighth postoperative day, because of the persistency of the vomiting and the onset of abdominal cramps in spite of drainage by a Miller-Abbott tube, a flat plate of the abdomen was taken. It definitely showed dilated small bowel and a shadow suggestive of a second gallstone within the lumen. (Fig. 2.) There were apparently more loops involved than in the previous *x*-rays. Diagnosis was made of recurrent gallstone ileus due to stone in the jejunum below the site of the previous jejunotomy. Nonprotein nitrogen and chloride were 29 and 431, respectively. An emergency operation was performed that night.

Under sodium pentothal anesthesia (0.7 Gm.) the old incision was quickly opened. On withdrawal of about two feet of distended small bowel, the site of obstruction was identified within which there was a hard object about one inch in diameter and beyond which there was collapsed bowel. The remaining twenty odd feet of distal small bowel was now delivered and palpated for the presence of an additional stone, but none was found. After this, the dilated portion of the bowel was palpated up to the site of the previous operation. At this point there was a rather firm adherence between the omentum and the suture line which was apparently causing no obstruction. It was thought wisest not to release these adhesions, so the remaining two to three feet to Treitz's ligament were not examined. The gallbladder area was again palpated without positive findings due to the adhesions. The stone was apparently in the midjejunum; it was milked down about three inches into normal bowel with some difficulty. It was removed via a transverse incision which was closed transversely with a continuous suture of No. 00 chromic catgut, reinforced with interrupted mattress sutures of fine black silk. The lumen was very slightly constricted and easily admitted the forefinger. It should be mentioned that the distance between the two jejunotomies was approximately three feet, and that a distance of at least two feet below the first operative site was examined at the first operation, but no farther because of the collapsed character of the bowel. Again 5 Gm. of powdered sulfathiazole was sprinkled into the

abdominal wound, a small portion being smeared over the suture line, the wound was closed with silver wire sutures. The total time of operation was about fifty minutes. The convalescence was essentially uneventful, the wound healing per primum.

A check gastrointestinal series, on December 19, 1941, gives a clear demonstration of the persistence of the biliary fistula at least a month after discharge of the two stones. (Fig. 3.)

Case II. Mrs. A. E., sixty-five years of age, was admitted on April 15, 1941. Her symptoms began two weeks previous to admission with pain in the upper midabdomen radiating to the middle of chest. There were no jaundice or constipation. Nausea and vomiting occurred three days previous to admission initiated by sudden onset of severe cramping pain in the right subcostal region and radiated to the right scapula. There were no chills or noticeable fever. She had had recurrent attacks of gallbladder disease.

On physical examination the abdomen was not distended. There was moderate tenderness of the subcostal region with slight spasm and rather marked tenderness over the entire left lower quadrant. No masses or hernia were found. Pelvic rectal examination was essentially negative. Her temperature was 99°C., pulse 86, respiration 22, blood pressure 122/68, hemoglobin 88 per cent, nonprotein nitrogen 71, sugar 140.

Vomiting persisted for the first nine days in the hospital so that intravenous therapy was practically her only source of nourishment. She appeared weaker but a gastrointestinal series taken on April 24, 1941 revealed a high intestinal obstruction with barium in the biliary tree and an oval shadow, apparently a stone, within the lumen of the intestine. (Figs. 4, 5 and 6.)

A diagnosis of gallstone ileus was made due to the presence of a gallstone in jejunum. In spite of intravenous therapy and gastric lavage the patient's course was downhill. Nonprotein nitrogen was 87 and there was a 3+ acetone in the urine.

On April 25, 1941, under ether anesthesia, a right rectus incision was made and the abdomen easily entered. The distended small intestine was traced distally to a point at the terminal portion of the jejunum where a large gallstone was found producing obstruction. This was removed with a transverse incision closed with a continuous mattress suture of No. 00 chromic catgut, reinforced with two layers of interrupted Lambert sutures of fine black silk. The lumen admitted the tips of two fingers. The liver felt perfectly normal. There were dense adhesions about what appeared to be the gallbladder and the adjacent duodenum. The omentum also enveloped these structures. No other stones were palpable in this area, but there was no systematic search of the entire length of small gut either above or below the obstruction. No attempt was made to free the adhesions to demonstrate the connection between the duodenum and the gallbladder. The abdomen was quickly closed with the patient in good condition.

Except for a low grade infection of the wound the patient made an uneventful recovery and was discharged on the nineteenth postoperative day.

A check *x*-ray one month after operation revealed barium in the biliary tract indicating persistence of a biliary fistula. Three months after operation, the patient was admitted with abdominal pain most marked in the right upper quadrant associated with nausea and vomiting and slight jaundice. A gallbladder series taken at this time revealed a nonfilling gallbladder. After a few days of conservative treatment, the symptoms subsided and the patient was discharged.

Eight months after operation, the administration of barium by mouth revealed no evidence of a fistula. She has since enjoyed good health.

Case III. The third case, Mrs. A. N., was a fifty-three-year old white female, admitted October 25, 1939, with a diagnosis of acute mechanical obstruction and diabetes mellitus. (One member of the house staff suggested gallstone ileus.) On *x*-ray a flat plate of the abdomen confirmed the diagnosis of obstruction only. At operation the gallbladder was buried in dense adhesions and except for definite distention the upper intestinal tract was normal. There was marked edema and inflammatory reaction around the ileocecal valve. A stony object was identified in the transverse colon and milked down into the rectum. (This object was removed two days later on rectal examination and identified as a gallstone.) No other pathological condition of the remaining viscera could be demonstrated. After a stormy post-

operative course of two weeks, complicated by exacerbation of the diabetes, the patient died of generalized peritonitis.

DISCUSSION

The extremely high mortality demands early treatment. This becomes feasible only after diagnosis has been established. When nausea and vomiting are out of all proportion to other symptoms of gallbladder disease, gallbladder ileus should be considered and *x*-ray examination made. Evidence of intestinal obstruction from dilated intestine alone would justify immediate exploration; but if the biliary system is filled with gas or a stone can be seen within the bowel, exploration becomes imperative.

After locating the stone, a thorough search of the bowel above and below should be done if the patient's condition permits. Collapse of the bowel distal to the stone does not exclude the possibility of a second one below. This was experienced in the first case reported in which the second smaller stone had apparently produced only partial obstruction and was masked by the three feet of collapsed bowel proximal to it. That this stone could have passed the narrowed lumen at the suture line after the first operation is most unlikely. We believe that it could have been manipulated in a retrograde direction and removed from the original intestinal opening had it been found. When a large facet is noted on a gallstone, one should account for the second stone to avoid possible recurrence of ileus.

An occasional complication arises from diminution in the size of the lumen of the bowel due to method of closure. A longitudinal incision is recommended with a transverse closure, thus leaving the largest possible lumen.

REFERENCES

1. Martin, Frank. Intestinal obstruction due to gall stones. *Ann. Surg.*, *55*: 725, 1912.
2. Borman and Rigler. Spontaneous internal biliary fistula and gall stone obstructions. *Surgery*, 1: 349, 1937.
3. Judd, E. S. Internal biliary fistula. *Surgery*, 81: 305.
4. Wakefield, Vickers and Walters. Intestinal obstruction caused by gall stones. *Surgery*, *5*: 670.
5. Wakeley, Wilway. Intestinal obstruction by gallstones. *Brit. J. Surg.*, 23: 377, 1935.
6. Balch, F. Gall stone ileus. *New England J. Med.*, 218: 11, 1938.
7. Hinchey. Recurrent gall stone ileus. *New England J. Med.*, 218: 11, 1940.
8. Holz, Edmund. Zur Frage der Gallensteinileus. *Arch. f. klin. Chir.*, *155*: 166–176, 1929.
9. Pybus, A note on two cases of gall stone ileus. *Lancet*, 2: 812, 1922.
10. Moschowitz. *Ann. Surg.*, 61: 242, 1915.
11. Van Ravenswaay. Acute intestinal obstruction by large gallstones. *Am. J. Surg.*, 16: 56, 1931.
12. Schwarke. U Zweimaligen Gallensteinileus. *Zentralbl. f. Chir.*, 65: 1980–1985, 1925.
13. Drew. *Brit. J. Surg.*, 12: 803, 1925.
14. Rigler. Gallstone obstruction. *J. A. M. A.*, 117: Nov. 22, 1941.
15. Souttar. Discussion on acute intestinal obstruction. *Brit. M. J.*, 2: 1000–1001, 1925.
16. Vick. Statistics on acute intestinal obstruction. *Brit. M. J.*, 2: 546–548, 1932.
17. Courvoisier. Beitr. Z. Path. u. Chir. der Gallenweger. Leipsig, 1900. Vogel.
18. Powers. Acute intestinal obstruction due to impacted gall stones. *Surg., Gynec. & Obst.*, 47: 416, 1926.

A NEW TYPE OF RELAXING INCISION— THE DERMATOME-FLAP METHOD*

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THERE are three methods of making a relaxing incision in common use at the present time: (1) Leave the incision open to heal in by third intention; (2) leave the incision open to be skin grafted at a later date, and (3) primary skin graft from a remote site.

Each of these methods is open to some criticism. The first is a deforming procedure producing a raw open wound which may take months to heal. The second prevents much of the deformity, but requires two separate operative procedures. The third method is advised by Davis (1919). While this latter technic has many advantages over the other two it produces three separate wounds (primary operative incision, relaxing incision, and skin graft donor site). The use of relaxing incisions is an important adjunct to many surgical operations, for example, the removal of large superficial tumors or excision of osteomyelitic scars of the tibia. It is quite possible that if relaxing incisions were simplified, their increased use with resulting decrease in tension of the primary wounds would greatly facilitate healing of the latter in many difficult cases.

The method devised by the author and used in the following illustrative case has the advantage that the relaxing incision is made in the skin graft donor site, eliminating the necessity for a separate wound to obtain the graft.

CASE REPORT

J. W., male, aged twenty, had a large hemangioma of the skin and subcutaneous tissue of the anterolateral surface of the left thigh measuring about 15 by 35 cm., shown in Figure 1. This tumor had been present for many years, and interfered to some degree with the patient's walking, but, more urgently, with his induction into the armed forces.

FIG. 1. Hemangioma of anterior surface of left thigh.

Operation. A 30 cm. long elliptical excision was made on March 17, 1942, removing as much as possible of the large hemangioma which was found not to extend below the muscular fascia but to be connected with the latter at several points. It was found that the defect remaining was so large that it could not be closed without great tension, so a new type of relaxing incision was made on the anteromedial surface of the left thigh. A 20 cm. long dermatome graft averaging a little less than 6 cm. in width was cut from above downward using the Padgett-Hood dermatome. The dermatome was set to cut a graft of 0.012 inches in depth. The graft was left attached at its lower end and reflected inferiorly as shown in Figure 2. A vertical relaxing incision a little over 2 cm. deep was then made in the center

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of the donor area, also as shown in Figure 2. This spread to an average width of 2.5 to 3.0 cm., relaxing the tension on the primary wound sufficiently to allow closure of the latter. The graft was then sutured down into the defect made by the relaxing incision with numerous interrupted sutures, a portion of which is shown in Figure 3. Ten Gm. of sulfanilamide powder were then sprinkled over the graft and surrounding bare donor area. This was covered with fine mesh vaseline gauze, mechanic's waste and dry gauze and then the entire thigh wrapped with elastoplast, the primary incision on the lateral surface of the thigh having been covered with dry gauze.

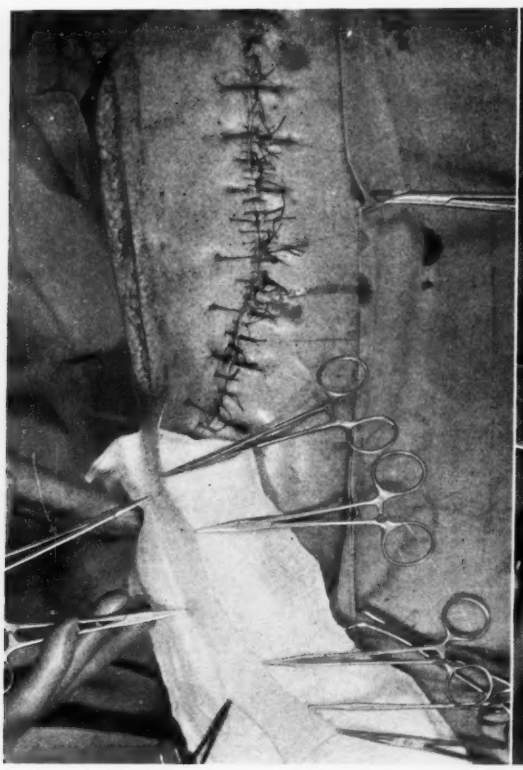

FIG. 2. Second stage of dermatome-flap relaxing incision. The hemangioma has been excised leaving the stitched incision on the right hand side of the figure. The dermatome-flap graft is turned down on the gauze. The relaxing incision has been made in the bed of the raw donor area. The graft is still attached at the lower end of the donor area thus producing the flap.

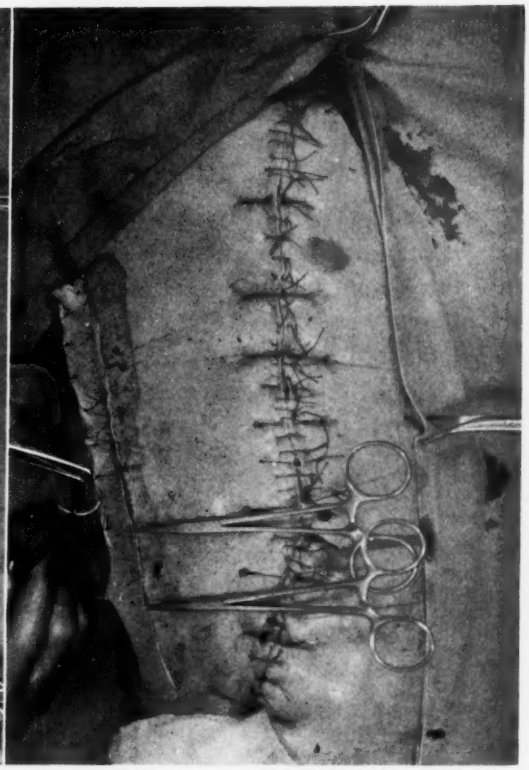

FIG. 3. Third stage of dermatome-flap relaxing incision. The graft has been turned back into the central portion of its bed and is being sutured with interrupted silk stitches into the relaxing incision.

Pathologic Examination. Sections revealed a cavernous hemangioma.

Postoperative Course. The first dressing of the primary incision was done on the ninth day after operation and the stitches were removed from the graft on the fourteenth day. Figure 4 shows the condition on that day just before stitch removal. The condition ten weeks after operation is shown in Figure 5, demonstrating good healing.

COMMENT

With the introduction of the Padgett-Hood dermatome skin grafting has become so much easier that new opportunities for perfection of surgical procedures are offered. The present operation is an example in kind and simplifies the use of relaxing incisions. The only difficulty that is apt to be encountered with this technic is that the very tautness of the skin which interfers with the closure of the primary wound is apt to hamper the taking of the dermatome graft. Razor grafts are most easily taken when the skin is taut, dermatome grafts when it is relaxed. For this reason, any sutures in the primary wound should not be tied until the graft is taken. An example of this is shown by the follow-

ing account: On May 21, 1942, i.e., two months after the original operation, the remainder of the hemangioma was removed from the thigh of patient J. W. A dermatome-flap relaxing incision was attempted on the posterolateral surface of the thigh. The skin was so taut, however, despite the fact that the primary wound was not closed, that no satisfactory graft could be cut. Therefore, an ordinary relaxing incision was made with primary closure by a dermatome graft from the opposite thigh. This resulted in an over 95 per cent immediate take.

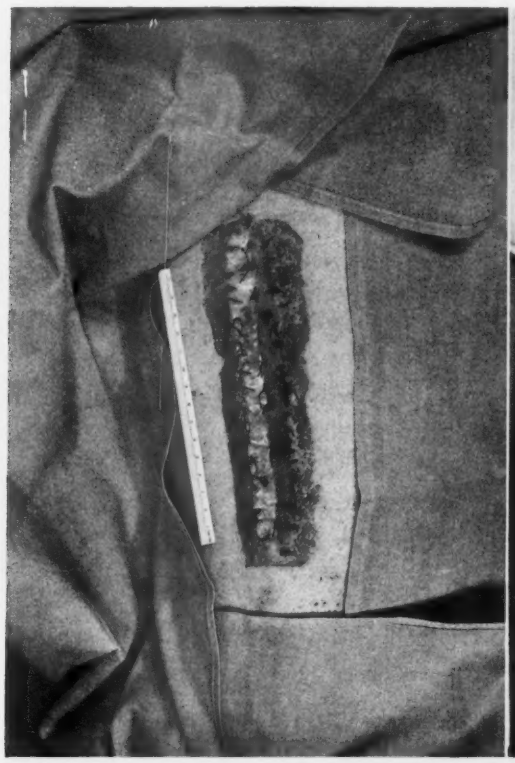

FIG. 4. The relaxing incision fourteen days later. The stitches were removed immediately after this picture was taken and the graft was found to be over a 98 per cent take. The attachment of the flap at the lower end of the defect is seen while the already healed but ungrafted lateral portions of the donor site are readily visible.

FIG. 5. Result ten weeks later. The depression left by the relaxing incision and covered by the graft is now practically flush with the surrounding skin. The wound and relaxing incision are entirely healed.

TAKING OF DERMATOME GRAFTS

With a personal experience of taking over sixty dermatome grafts, the author has the following suggestions for carrying out the technic of this procedure:

1. *Selection of a Donor Area.* With the Padgett-Hood dermatome, practically any portion of the body is available for furnishing a graft, whether that area be concave or convex. The abdomen and thighs are most suitable.

2. *Preparation of Donor Area.* This is best done with alcohol followed by ether. The use of certain other antiseptics interferes with the adhesion of the glue.

3. *Adjustment of Dermatome.* The depth of the graft should be 0.012 to 0.020 inch for the average adult, while in children or those with atrophic skins it should be less than the average figure. For a child two to five years of age a depth of 0.007 to 0.009 inch is satisfactory. Thinner grafts are best for covering granulating surfaces, while thicker ones are best for clean cases.

4. *Application of Glue.* The glue should be put on as a thin sheet without bare spots. A tongue depressor or the base of the dermatome is useful for applying the glue uniformly. It should be painted on both skin and drum surface and allowed to dry for at least sixty seconds.

5. *Taking of Graft.* The donor area should be adjusted so that the skin is relaxed as much as possible. This is exactly the opposite from what is necessary when razor (Thiersch) grafts are taken, in which case the skin is held tautly by boards or an assistant. This difference is important and well meaning assistants should be waved aside. Taking of a dermatome graft is best a one man job. If the desired graft is to be narrower than the width of the drum, it is far easier to apply the glue uniformly and then rub off the areas not to be included than to attempt to spread the difficultly manageable wet glue according to any pattern. The graft is taken in the usual manner with a sawing motion. For application of a dermatome flap graft, the end of the graft is left attached. It is not for a moment considered that this attachment furnishes nutrition to the graft; the latter is merely left intact to facilitate subsequent resuture.

6. *Suture of Graft.* This is best done meticulously with numerous interrupted fine silk sutures. These should be applied both around the edges and across the bed of the graft, this latter step being particularly important for a dermatome-flap relaxing incision in which instance the graft is, of necessity, applied to a concave surface. Since the relaxing incision takes up most of the width of the graft, the rest of the donor site is left bare to heal in the usual manner, which is usually before the time of the first dressing.

7. *Dressing of Graft.* The combined grafted area and uncovered donor site are covered with a fine sprinkling of sulfanilamide powder, then by fine mesh vaseline gauze, mechanic's waste, and finally a dry dressing covered by elastic adhesive. The groove left by the relaxing incision is packed with a moulded piece of mechanic's waste to produce uniform pressure.

8. *Subsequent Care.* Stitches are removed on the fourteenth day at which time the first dressing is changed. The healing of the bare donor area is best accomplished by not changing the dressing until the fourteenth day. Since this prevents removal of the stitches in the grafted area until that time, this might be considered a theoretical disadvantage of the procedure. No difficulty was encountered in the case under discussion, however, and stitches left in other skin grafts for this period of time also led to no difficulties.

SUMMARY AND CONCLUSIONS

A new method of making a relaxing incision is presented. This combines the advantages of primary closure by a skin graft with the lack of necessity for making a separate wound to obtain closure.

The dermatome-flap relaxing incision consists briefly in making a dermatome graft which is left attached at one end and reflected back. The relaxing incision is then made in the donor area or bed of the graft and the flap turned down again to cover the raw area made by the incision.

This method is applicable to all situations in which relaxing incisions are useful. The latter are of especial advantage for wounds of the extremities in which large superficial tumors or scars are excised.

REFERENCE

1. Davis, J. S. Plastic Surgery: Its Principles and Practice. Philadelphia, 1919. P. Blakiston's Son & Co.

CONTROL OF SOMATIC PAIN*

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THE relief of pain has always been one of the chief functions of a doctor. Pain of visceral origin has been the reason for the existence of a surgeon. However, the differentiation between visceral and somatic pain has not always been an easy one to make.

The types of somatic pain to which we have devoted most of our attention are those neuralgias which are segmental in distribution and which are associated with tenderness. Pain due to segmental neuralgias, by virtue of its variation in location, character and intensity, may simulate the pain of almost any form of visceral disease.

Evaluation of the pain in these patients has been made more definite by various factors: (1) The finding of tender points at the emergence of the posterior, lateral or anterior cutaneous branches of the intercostal nerves; (2) the establishment of tenderness in segments corresponding to definite dermatomes which are associated with the pain; (3) the fact that segmental tenderness is rarely initiated by the pain of visceral stimuli, unless a widespread peritonitis is present; (4) the finding of reduced skin surface temperature which is often associated with the pain and tenderness, and (5) following nerve block, pain and associated tenderness should disappear simultaneously.

In many series of operations, the failures reported are chiefly in patients whose cardinal complaint was pain. This I believe is not due to incomplete or incompetent surgery but to failure in diagnosing the source of the pain.

In 1926, when a former member of the Academy of Surgery, the late Dr. J. Berton Carnett, first wrote about intercostal neuralgia of the abdominal wall, he stressed this same fact.

His work met with differences of opinion, but his basic reasoning has been substantiated many times. It is very true that to follow his teachings of that time might have led to some serious mistakes. On the other hand, it would have prevented many useless operations. In his teachings, he advocated differentiating visceral from somatic pain. He described his tests to accomplish this. He gave a series of causes for the existence of somatic or as he called it, intercostal pain, and lastly, he attempted to outline methods of treatment for this condition.

This latter fact was unfortunate and was forced upon him and his staff rather prematurely. Having brought the picture of surface pain to the attention of practitioners they demanded some method of treatment. Among the recommendations for treatment was, of course, the classic one of "eliminate the cause." This we tried to do, but in many cases we found that the pain persisted long after the apparent cause had been removed. Something more was needed in those patients whose toxic foci were eliminated and postural defects corrected, with no relief of their pain.

At this stage of development of our clinical problem, an attempt was made in cases of local pain and tenderness to inject with novocain. As one might expect, most of the cases got only temporary relief. However, quite a few got prolonged relief encouraging us to repeat the injections. When prolonged relief was obtained by such a simple procedure, we were of the opinion that the basic cause or causes were probably corrected in conjunction with the infiltration.

About 1931, one of the men on Dr. Carnett's service at the Graduate Hospital, Dr. B. D. Judovich, did some work on the

* Annual Oration for 1941. Read before the Academy of Surgery, November, 1941, Philadelphia.

pitcher plant—Sarracenia purpurea. He prepared an aqueous solution derived from this plant, and observed that it was of value in relieving pain of neuralgic origin. It was believed at that time that its properties were due to the presence of amines. It was noted that the preparation had an action upon sensory nerves, relieving neuralgic pain without producing changes in skin sensation and having no effect upon motor nerves.

Dr. Carnett suggested that Dr. Judovich be allowed to work in what we called the Intercostal Neuralgia Clinic. Heretofore we had been trying to determine the cause of the pain, and treat by means of eliminating focal infections, correction of postural defects, giving Goldthwaite exercises and the occasional injection of novocain solution in some of the more persistent cases of localized pain and tenderness.

From then on, even though we did not know the actual active principle of the solution we called Sarapin, it was administered to numerous patients suffering with pain of somatic origin.

Controls of novocain, saline and water were used, and the results recorded. The key numbers of these various ampoules were changed several times, and on analysis in each series, it was found that Sarapin produced prolonged relief in contrast to fleeting or negative results with the other solutions. In a number of instances, patients who had been injected with novocain with only a short period of relief of pain, obtained prolonged relief by a subsequent injection pitcher-plant distillate.

Toxicity tests revealed that it was harmless. It caused no tissue coagulation nor sclerosis. This action was unusual and difficult to substantiate. We were treating a subjective symptom, and laboratory animals gave no actual data except in reference to toxicity. Routine pharmacologic tests in three different laboratories threw no light upon the problem.

Following its injection of peripheral nerves, there were no cases of motor weakness, nor loss of touch, pressure, pinprick nor temperature sensibility. In some cases, one infiltration of the distillate was sufficient to provide permanent relief of pain, even though of long duration. The psychic factor of relief in this type of pain has largely been ruled out by establishing the presence of tenderness in the dermatomes of the painful segments.

In intercostal neuralgia, paravertebral injection of the nerve trunks involved, results in an immediate intensification of the pain, followed during the next thirty minutes, by a gradual contraction of the hyperalgesic area in the dermatome supplied by the nerve. In a large number of cases it is followed by complete relief of neuralgia.

Because of the segmental overlap, the effect of the distillate upon sensations other than neuralgia cannot be evaluated.

If, in a case of sciatic neuralgia, the region of the sacrosciatic foramen is infiltrated with the pitcher-plant distillate, there is relief of the neuralgic pain as well as of tenderness along the nerve trunk. This is similar to results from infiltration of novocain, but in contrast to the action of novocain there is no numbness, no loss of sensibility and no motor weakness. Reflexes remain unchanged.

In 1939, investigation was made by Dr. Winifred Stewart and Dr. Joseph Hughes, using the cathode ray oscillograph to determine the action of the pitcher-plant distillate upon the nerve impulse.

Their studies indicated that the somatic c wave impulse, which is supposedly transmitted by way of the small unmyelinated fibers, was depressed in each instance. A report of these findings was made in 1940 by Stewart, Hughes and Judovich in which they stated: "The ability of pitcher plant distillate to abolish neuralgia pain which, like fascial pain, is aching, poorly localized, and frequently associated with nausea and sweating, and at the same time, to leave pinprick as well as other forms of sensibility unaffected, led us to inquire further into its physiological action, and to attempt to determine its active principle.

"The effect of pitcher plant distillate on the action potentials of the saphenous nerve of the cat was observed. The nerve was mounted in a nerve chamber in a gas mixture of five per cent carbon dioxide and ninety-five per cent oxygen. The temperature was maintained at 37.5° to 38°C. The nerve was so mounted that it could be bathed in the solution to be studied. The pitcher plant distillate was adjusted to a pH. of 7.4. The action potentials were recorded on a cathode ray oscillograph.

"After five minutes immersion in pitcher plant distillate, the maximal A spike was somewhat reduced while the C fiber potentials were obliterated."

For the first time it appeared that we had some definite objective proof that the solution we had been using should relieve pain. It became vitally important to us to know the chemical constituents of this solution. The first report we received on the analysis showed that the crystalline compound which was isolated was ammonium chloride. Experiments in the laboratory were carried out with distillate of pitcher-plant solution of known ammonium chloride. All three solutions gave the same result. Clinically, injections of Sarapin and of a solution of ammonium produced the same prolonged relief.

On checking the chemical process by which the distillate was obtained, Judovich found that the end result should have been a sulfate and not a chloride. Accordingly, further experiments were carried out with a solution of known ammonium sulfate. Both clinically and experimentally the results were parallel to those found with the solution of ammonium chloride. From this it was readily deducted, that, as the ammonium radical was only constant, that it was the active principle responsible for our results.

These observations on actual patients led us to believe that neuralgic pain and pinprick are mediated by separate fiber groups. Clinically, however, we have been unable to relieve pain of visceral or sympathetic origin by the injection of ammonium salts.

In two instances the first and second lumbar sympathetic ganglia were injected in a patient with vascular occlusion of the lower extremity. There was no change in the skin surface temperature of the leg following infiltration of these points with ammonium salts. The needles were left in place and at the end of twenty minutes 2 per cent novocain solution was injected. Within two minutes a definite rise in skin temperature was obtained. All patients benefitted by these injections were cases of pain of somatic origin associated with tenderness.

On occasion, the infiltration of the pitcher-plant distillate and the ammonium salts have been of value in differential diagnosis; neither of these substances has any effect upon vascular pain or pain of visceral origin.

Just what the difference is in the unmyelinated C fiber of peripheral distribution which responds to these injections, and the unmyelinated C fibers of the sympathetic nerves and their ganglia which do not respond to these injections, we do not know. Experiments are being conducted by Dr. Stewart and Dr. Hughes upon sympathetic fibers to determine the effect of ammonium salts upon the nerve impulse in this type of tissue.

This has no doubt been a prolonged explanation of a simple procedure, but the clinical results have been so satisfactory to some of us, that the confirmation of our ten years of clinical observations by laboratory proof, make it seem worth while to render this report.

Our work in attempting to control pain is by no means complete, as the same solutions are now being tested intraspinally for intractable pain. To date the results in certain cases have been most promising, but more data must be collected before definite conclusions can be made.

I am not recommending regional infiltration as a cure-all for aches and pains, but without it, we would have been unable to

relieve many patients of their persistent pain.

SUMMARY

1. Segmental neuralgias may often simulate the symptoms of visceral disease. These very often account for pain which persists following surgery.

2. Various factors are mentioned which are important in the differentiation of pain of visceral and pain of somatic origin.

3. Regional infiltration appears to be the most efficacious method of treatment for somatic pain. It is also of value in diagnosis.

4. The use of the pitcher-plant extract, in many patients, has afforded prolonged relief as compared with procaine.

5. Injection of solutions of ammonium inorganic salts both locally and intraspinally have given promising results. The advantages are nontoxicity and absence of tissue damage.

6. A résume is given of the experimental and clinical value of both the pitcher-plant and ammonium salts.

Occasionally a patient will receive an overdose of a local anesthetic agent and have convulsions or convulsions may develop under general anesthesia. If the convulsions are severe, death will ensue unless artificial respiration is carried out to ventilate the patient enough to support life. The use of an anticonvulsant drug may be necessary to accomplish this.
From "Clinical Anesthesia" by John S. Lundy (W. B. Saunders Company).

THE CURATIVE TREATMENT OF HEMORRHOIDS*

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INASMUCH as the anorectal region is easily accessible to examination and treatment, the patient afflicted with hemorrhoids expects from his physician and is entitled to permanent cure. These are to be accomplished with a minimum loss of working time and little or no pain. These desiderata can and should be attained. Too often they are not.

The term, hemorrhoids, refers only to varicosities of the veins of the hemorrhoidal plexus. Internal hemorrhoids occur proximal to the anorectal junction and external hemorrhoids distal to this line. Hemorrhoids may remain innocuous for years. They cause symptoms when they become the seat of further pathological changes incident to trauma and infection. Bleeding from internal hemorrhoids usually results from laceration of the varix by the trauma of defecation. Prolapse and partial strangulation of an internal hemorrhoid results in perianal soiling with bloody mucus, pruritus and occasionally pain. Pain associated with hemorrhoids is due to inflammatory edema resulting from mucosal fissuration, thrombus formation or strangulation. Wholly or in part these symptoms finally force the patient to seek relief, too often after a long course of fruitless self-medication with salves, suppositories and numerous patent pile remedies.

SCLEROTHERAPY

Freedom from pain and loss of working time, as well as cost of hospitalization makes the sclerotic injection treatment of hemorrhoids desirable. The effectiveness of sclerotic injections depends upon the fibrosis resulting from the inflammatory reaction induced by the deposition of a chemical into the submucosa above, or into the lumen of the hemorrhoid The relative technical simplicity of the method makes it available to the general practitioner who is not necessarily a skilled surgeon. Unfortunately, permanent cure can be attained in only a small percentage of patients. Sclerotherapy is permanently effective only in those instances in which hemorrhoids are internal, small in size and number and not associated with mucosal prolapse. Such ideal cases are rarely seen clinically because at this stage symptoms are few and infrequent. Sclerotherapy is valuable in the treatment of large hemorrhoidal varicosities to stop hemorrhage temporarily until operation can be performed. It also has its place in allaying symptoms caused by hemorrhoids in cardiacs, nephritics, diabetics, the senile, and in all conditions in which operation is hazardous or impractical. When injection therapy is administered, it is essential to follow and examine patients periodically for years, as it will be found that recurrences of new varicosities requiring further injection commonly occur in the interval since previous treatment. Often patients who have been injected for years eventually submit to operation because of the discomfort resulting from increasing mucosal prolapse which cannot be further controlled by injection.

The technic of injection, indications, contraindications and dangers, have been described by Buie,[1] Gabriel,[2] Hirschman,[3] and Swinton.[4] My personal preference in treating properly selected cases is the use of phenol and glycerin, each 5 per cent in water, injected through a Hirschman-type anoscope using a No. 23 gauge angulated tonsil anesthesia needle. In my experience, the injection of 5 per cent quinine and urea caused inordinate pain despite proper technic, and slough occa-

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sionally resulted in quinine sensitive patients. Almond, and later peach kernal oil as diluents for phenol were discarded because of the occasional occurrence of eleomas, benign fatty tumors in the submucosa at the site of the injection. These tumors can coalesce to cause partial stricture (Rosser[5]).

Sclerotherapy, in short, can cure hemorrhoids in a limited number of early cases and is a valuable palliative measure to control hemorrhage. When utilized, its temporary efficacy must be clearly explained to the patient, emphasis being placed on the necessity for continued observation and possible re-injection for years.

HEMORRHOIDECTOMY

Physiological limitations of sclerotherapy often result in recurrent hemorrhoidal lesions. It is difficult, however, physiologically to account for the all too frequent "recurrence" of hemorrhoids and mucosal prolapse after purported surgical excision. The term, "recurrence," in this connection is a misnomer. A varix which has been excised cannot recur. Hemorrhoids which occur following hemorrhoidectomy must be due to physiological enlargement of varices and prolapsed mucosa left intact after an inadequate, incomplete operation. These, not infrequent, operative failures may result from carelessness or inexperience on the part of the surgeon.

Its safety from mortality as well as the technical ease of performance relegates hemorrhoidectomy to the category of minor surgical procedures. The busy surgeon usually schedules hemorrhoidectomy as the final case after several tedious, prolonged, arduous laparotomies. He performs this operation when tired, irritable, and perhaps overdue for office consultations. Under such circumstances, I have seen surgeons rapidly overdilate the sphincter muscle; the three primary hemorrhoids are next hurriedly clamped, excised, and the stump sewn over, often including part of the subcutaneous sphincter muscle in the ligature. Secondary hemorrhoids are disregarded, either from neglect or from fear of excessively denuding mucosa. The excessive perianal edema and pain which frequently follow such operations are due to sphincter spasm resulting from the trauma of overdilation and from strangulation of muscle fibers included in the hemostatic ligature. Failure to remove the minor secondary hemorrhoids results in physiological enlargement of these varicosities with early return of symptoms. The surgeon is confronted only too soon with an irate and dissatisfied patient justifiably accusing him of incompetence in performance of the operation.

It is the exceptional patient who submits to operation with only three primary hemorrhoids involved. After many years of self-medication and perhaps an unsuccessful course of sclerotic injections, the patient usually comes to operation presenting a veritable ring of prolapsed ulcerated, internal hemorrhoids, hypertrophied papillas, mucosal fissuration and numerous skin tabs. Faced with such a formidable array of lesions, the inexperienced surgeon fearing postoperative stricture as a result of excessive tissue loss, wisely concludes that discretion is the better part of valor and removes only the larger varicosities. Revision operations in such cases are frequent.

Inadequate hemorrhoidectomies will continue to be performed until the general surgeon shows willingness and interest to apply the newer concepts of anorectal anatomy described by Levy[6] in this country and Milligan,[7] in England, to their technic of hemorrhoidectomy. Many surgeons are slow to utilize measures recently developed which enhance the postoperative comfort of hemorrhoidectomized patients. The laity and physicians alike recall the frightful pain and the discomfort of prolonged obstipation which followed hemorrhoidectomy by the now obsolete clamp and cautery method and the barbarous "whistle" plug necessitated for hemostasis.

One extremely important point should be emphasized: Frequently, a patient complains of rectal bleeding and undergoes hemorrhoidectomy. However, bleeding persists after operation. Eventually a belated digital and sigmoidoscopic examination reveals the primary cause of bleeding to be a neoplasm of the rectum or sigmoid. Competent rectosigmoidal examination by means of the electrically lighted sigmoidoscope infallibly must be conducted previous to any anorectal operation. By this means rectal malignancy can be discovered in the early resectable stage. Physicians can no longer shirk their responsibility to diagnose cancer of the lower bowel early, especially when rectal bleeding is a prominent symptom.

Much has been written on the technic of hemorrhoidectomy and it may be perhaps presumptious to offer still another note on this subject. Competent general surgeons, however, do not attain uniformly satisfactory results in their hemorrhoidectomies as is attested by the too frequent revision operations for "recurrences" and proctotomies for stricture. The postoperative course of their patients is needlessly painful and hospitalization is prolonged. The procedure to be described was designed to avoid these disadvantages, to minimize debility and excess nursing care, and to enable the patient to resume his work in about eight days.

ANESTHESIA

Preoperative preparation is simple. The patient is admitted the evening before operation; an effectual soapsuds enema is administered, following which the patient is shaved. Adequate sedation is administered to insure sound sleep. On arising a pint of warm saline solution is instilled into the rectum and immediately expelled. Rectal lavage is repeated until the return is clear. Pentobarbital sodium, 0.2 Gm., is administered two hours before operation.

Caudal epidural block with 1 per cent procaine solution affords ideal anesthesia for at least one hour. Failure of anesthesia, 3 per cent in my most recent series, is attributable to anatomical deformities which prevent deposition and retention of the medication in the caudal epidural space. For anal surgery, successful caudal block is ideal because its use avoids the nausea, vomiting and special nursing care associated with recovery from inhalation anesthesia, or the headache, nausea and vomiting which followed spinal anesthesia in 30 per cent of the patients operated upon by Jennings and Karabin[8] for anorectal lesions.

With the patient prone on the table in the inverted jack-knife position, 60 cc. of 1 per cent procaine solution is deposited in the caudal canal by the usual technic (Labat[9]). The time interval required for effective anesthesia is about fifteen minutes. Any actual loss of time can be avoided by completing the administration of the anesthesia before the surgeon scrubs. If the surgeon himself performs the nerve block, gloves are worn for this procedure which is then followed by proper scrubbing and draping. If block anesthesia is unsuccessful, local infiltration anesthesia is administered.

OPERATION

The comfort of the patient, surgeon and assistant during operation is enhanced by maintaining the patient in the prone, inverted, jack-knife position. The buttocks are separated by wide adhesive straps attached thereto and thence to the frame of the table. After painting and draping, the anal sphincter is found to be relaxed and easily admits three fingers. Use of the ingenious ring retractor devised by Hullsiek,[10] affords incomparable exposure and dispenses with a second assistant. (Fig. 1.)

The so-called "ligature operation" fulfils all the requirements of a satisfactory operation for hemorrhoids. This operation, in principle, was originated one hundred years ago by Mr. Frederick Salmon, founder of the St. Mark's Hospital for Rectal Diseases in London. It has been used continuously to this day at that institution by such masters of surgery as Allingham, Lockhart-

Mummery, Gabriel and Milligan. In a recent paper Milligan[7] described in detail modern concepts of the surgical anatomy of

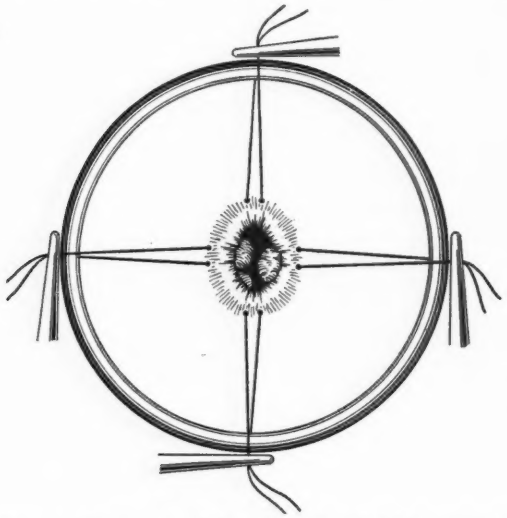

Fig. 1. Exposure of the operative field by means of the Hullsiek anal retractor.

the anal canal emphasizing its relation to the operative treatment of hemorrhoids. These anatomical principles have been followed in the operation herein described.

After exposure by traction sutures, the anorectal region is carefully inspected and the operative sequence planned. The largest internal hemorrhoid is grasped in an Allis clamp and prolapsed to expose its proximal attachment, the mucosal pedicle. The mucosa is incised parallel to and very close to the base of the hemorrhoidal pedicle bilaterally. (Fig. 2.) The analogus external hemorrhoid or skin tab is now secured by a second Allis clamp and the hemorrhoidal mass is elevated by gentle traction. A small superficial incision is made through the perianal skin about 1 cm. below and parallel to the anocutaneous margin. (Fig. 3.) The thin fibers of the corrugator cutaneous muscle are now seen traversing the wound. These fibers are carefully severed and with blunt, knife-handle dissection directed proximally, a line of cleavage is exposed which leads into the perianal space. The subcutaneous external sphincter, a thin band of smooth muscle, is thereby exposed. This muscle is retracted laterally and further blunt dissection directed proximally next uncovers the distal portion of the fibrous longitudinal muscle of the rectum. Keeping close to the base of the hemorrhoidal pedicle, incision three is extended proximally to join incisions one and two. Care in dissection is rewarded by absence of free bleeding. The hemorrhoidal pedicle now swings free and contains only hemorrhoidal varicosities, redundant rectal mucosa and skin tabs.

A 30 cm. strong, heavy silk or cotton suture threaded double on a curved hernia needle is passed through the fibrous longitudinal muscle of the rectum at the apex of the perianal space and continued medially through the center of the hemorrhoidal pedicle at its proximal attachment to emerge through the rectal mucosa. (Fig. 4.) The needle is cut away and each of the remaining sutures is tied tightly on its respective side of the point of transfixion. Advantages of this method of high ligation are first, perfect hemostasis assured by the inclusion of the fibrous longitudinal muscle of the rectum thereby anchoring the ligature and preventing slipping. Secondly the sensory nerves of the anus and the subcutaneous external sphincter muscle are distal to the point of ligation. These sensitive tissues are thus excluded from the ligature, thereby avoiding excess pain and sphincter spasm. After final inspection, the hemorrhoidal mass is excised 0.5 cm. distal to the ligature. The stump is replaced in the rectum to slough off spontaneously in about eight days leaving a smooth, cleanly granulating base.

The two remaining primary hemorrhoids are similarly treated as are secondary hemorrhoids when present. Other lesions such as mucosal fissures, hypertrophied papillas and infected crypts are excised independently or as part of the hemorrhoidal mass. After completion of a properly performed operation, a maximum of rectal mucosa remains intact between excised areas, thereby insuring freedom from stricture.

The anorectal region cannot be adequately sterilized nor can it remain

surgically clean after operation. To attempt primary closure of the skin wound is to invite disaster in the form of infection. Consequently, to promote better dependent drainage, skin defects are left open to heal by granulation easily and painlessly in two to three weeks.

In hypersensitive patients, postoperative comfort may be further enhanced through the use of anesthetics, eucupin, anucaine, butecain or numerous others, in oil. When injected into the sphincter muscles, partial paralysis ensues which results in freedom from spasm for one to three weeks thereby increasing postoperative comfort. These chemicals are tissue irritants as shown by Kilbourne[11] and in patients whose tissue vitality is low, diabetics, nephritics and cardiacs, the use of chemicals is contraindicated because of the likelihood of slough formation. When utilized, 10 cc. of the warmed oil is injected through the denuded wounds into the external and internal sphincter muscles, these being supported during injection, on the crooked index finger placed within the rectum. Gentle massage of the muscle after injection prevents pooling of the oil and improves its distribution.

Retraction sutures are now removed, a thin sliver of vaseline gauze is inserted in the anal canal to separate raw surfaces, gauze dressings are applied and held in place by wide adhesive straps across the buttocks. "T" binders immediately postoperatively are unsatisfactory as they require constant adjustment to maintain dressings in place.

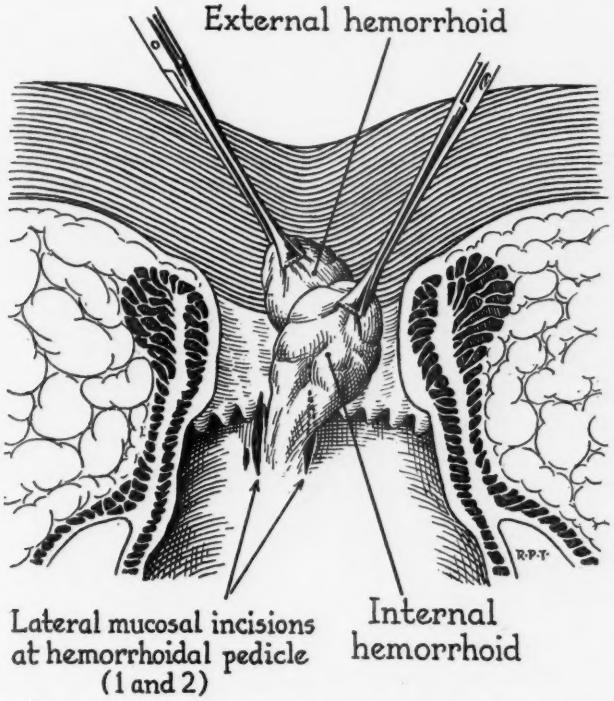

Fig. 2. Incisions at the base of the hemorrhoidal pedicle.

POSTOPERATIVE REGIMEN

Before the patient is removed from the operating room, 30 cc. of 0.5 per cent aqueous solution of mercurochrome is instilled into the urinary bladder per catheter. This procedure has resulted in reducing to less than 1 per cent the number of patients with postoperative urinary retention requiring catheterization (Woodruff and TeLinde),[12] (Helfert and Granet).[13]

Directly postoperatively, the patient is allowed a liberal high vitamin, low roughage diet; sedation for pain is prescribed as required; heat is applied to the perineum and the patient is allowed out of bed to

void if necessary. Twenty-four hours after operation the dressing and vaseline gauze are removed and sitz baths, two or more

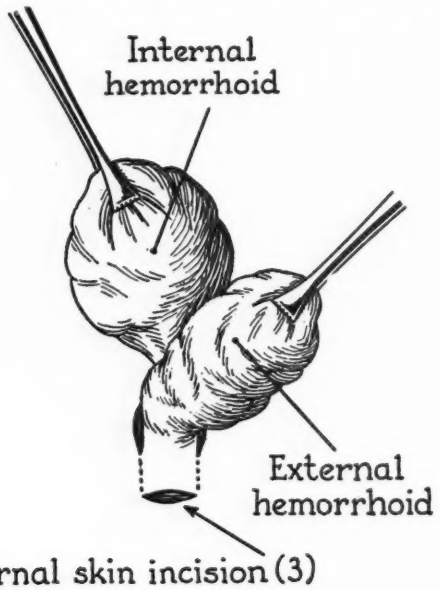

Fig. 3. External skin incision.

daily, are administered. The patient is allowed up and one ounce of petroleum-agar emulsion is administered daily. Usually, defecation takes place on the third day or if delayed, is stimulated by a small warm water enema. The patient can be discharged from the hospital on the fourth or fifth day. He continues on petroleum-agar and sitz baths and after defecation is required to take a warm rectal lavage, self administered, through a No. 24F urethral catheter. This procedure cleanses the granulating surfaces of residual feces and improves the comfort of the patient. After three weeks, epithelialization of the wounds should be complete. After unusually extensive operations, physiologic swelling of scar tissue may occur at about the sixth week which may narrow the lumen of the anal canal to admit only the fifth finger when palpated. Dilatation at this time is contraindicated and unnecessary inasmuch as swelling soon subsides and the anal canal regains normal width.

CONCLUSIONS

1. Varices of the hemorrhoidal plexus (hemorrhoids) cause symptoms when complicated by lesions resulting from trauma, infection or prolapse.

2. Sclerotherapy is limited in its applica-

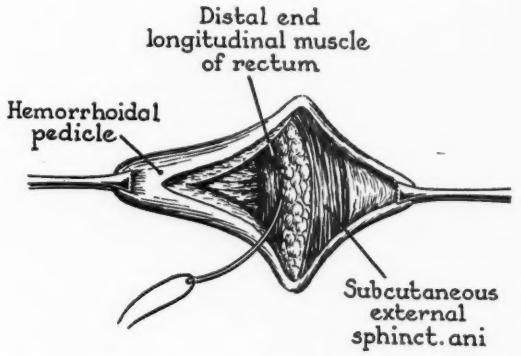

Fig. 4. Dissection completed showing the point of transfixion of the hemorrhoidal pedicle.

tion and is successful only in patients with small uncomplicated internal hemorrhoids. It is useful in the treatment of hemorrhoidal bleeding in patients who are severe cardiacs, nephritics and in the senile. When utilized, the patient must be warned of its temporary efficacy and of the high recurrence rate.

3. Hemorrhoidectomy when properly and accurately performed implies erradication of all hemorrhoidal varicosities. Most so-called "recurrences" result from physiologic enlargement of secondary varices remaining after an incomplete hemorrhoidectomy. This may result from a hurried, poorly planned or careless operation or from the timidity of an inexperienced surgeon who rightly fears stricture formation.

4. Patients complaining of rectal bleeding *must* have a carefully performed sigmoidoscopic examination prior to hemorrhoidectomy. By so doing, we can avoid the tragedy of discovering advanced rectal cancer in patients recently operated upon for "bleeding piles."

5. The operative technic of the modified "ligature" operation is described. Features emphasized are: (*a*) Caudal epidural nerve block anesthesia; (*b*) use of the Hullsieck anal retractor and the jack-knife position; (*c*) minimal denudation of the mucosa of the rectum and the mucoderm of the anus; (*d*) absolute hemostasis by the use of a

nonslipping transfixion ligature; (*e*) exclusion of the subcutaneous external sphincter muscle and the sensory nerves of the anus from ligation, thereby minimizing pain, edema and spasm; and (*f*) when not contraindicated, the use of oil soluble anesthetics to allay postoperative pain and spasm in hypersensitive patients.

6. Postoperative measures designed to minimize debility and excess nursing care are: (*a*) Prevention of postoperative urinary retention by instillation of 0.5 per cent mercurochrome solution in the urinary bladder; (*b*) establishment of an ambulatory regimen including hot sitz baths after twenty-four hours; and (*c*) immediate administration of a low roughage but full caloric and high vitamin diet.

REFERENCES

1. Buie, L. A., Bargen, J. A. and Rankin, F. W. The Colon, Rectum and Anus, p. 635. Philadelphia, 1932, W. B. Saunders.
2. Gabriel, W. B. The Principles and Practice of Rectal Surgery P. 40. London, 1932. H. K. Lewis.
3. Hirschman, L. Synopsis of Ano-Rectal Diseases. P. 205. St. Louis, 1937. C. V. Mosby.
4. Swinton, N. W. The injection treatment of hemorrhoids. *Labey Clinic Bull.*, 1: 21, 1940.
5. Rosser, C. Chemical rectal stricture. *J. A. M. A.*, 96: 1762, 1931.
6. Levy, E. Anorectal musculature. *Am. J. Surg.*, 34: 141, 1936.
7. Milligan, E. T. C., Morgan, C. N., Jones, L. E. and Officer, R. Surgical anatomy of the anal canal, and the operative treatment of hemorrhoids. *Lancet*, 2: 1119, 1937.
8. Jennings, W. B. and Karabin, J. E. Incidence of headache, nausea and vomiting following spinal anesthesia. *Am. J. Surg.*, 46: 317, 1939.
9. Labat, G. Regional Anesthesia. P. 444. Philadelphia, 1922. W. B. Saunders.
10. Hullsiek, H. E. New anal retractor. *Minnesota Med.*, 20: 300, 1937.
11. Kilbourne, N. J. Local anesthetics producing prolonged analgesia. *Surg., Gynec. & Obst.*, 62: 590, 1936.
12. Woodruff, J. D. and Te Linde, R. W. Postoperative care of the urinary bladder. *J. A. M. A.*, 113: 1451, 1939.
13. Helfert, I. and Granet, E. The prevention of acute urinary retention following anorectal surgical proceedures. *Am. J. Surg.*, 53: 129, 1941.

CLASSIFICATION OF WOUNDS AND THEIR TREATMENT*

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THE present military conflict plus the mobilization of industry is clearly proving the importance of early adequate prophylactic treatment of traumatic wounds. A sound knowledge of the practical principles of surgery of wounds is essential if we are to minimize the military and industrial disabilities.

The prevention of contaminated wounds from progressing to the infected stage may well have a definite bearing on the outcome of this war. The reduction in the morbidity of wounds in our industrial plants and on the battle fronts will eliminate the loss of manpower so necessary in this all out struggle. First aid treatment should reduce the possibility of further contamination also the avoidance of additional trauma to that already present. Bleeding should be controlled by a pressure pad over the wound or the proximal artery. A tourniquet may be necessary. Packing of the wound is to be avoided if possible. The wound should be covered with a sterile dressing. Rapid evaluation of loss of the physiological function of the part involved may be attempted if circumstances permit. Splinting should be done and rapid transportation to the proper facilities made available so that immediate treatment can be instituted.

All traumatic wounds are contaminated and potentially infected. The source of contamination in traumatic wounds is fourfold, namely, the penetrating instrument, the surrounding soil, the patient's skin and the bacteria of the first aid work or physician. Therefore, meticulous asepsis should be maintained with the use of masks and sterile gloves. Clinical and experimental evidence show that there is no method in use which renders a contaminated wound absolutely free of bacteria.[2] Therefore, the question as to whether a given wound remains aseptic or becomes infected, depends upon the virulence and type of bacteria which remain in the tissues, local conditions of moisture and temperature, and the resistance of the host.

The principles of treatment of traumatic wounds has been mentioned repeatedly by Mason,[9] Koch,[6] Kreuscher,[7] Reid and Carter.[10]

We shall discuss different types of traumatic wounds and their treatment:

1. *Abraded.* Simple cleansing should be done followed by the application of sterile or antiseptic ointment.

2. *Incised. Contaminated:* These are usually caused by stab wounds, glass, knives or other sharp instruments. The skin in the field of operation is shaved and scrubbed with tincture of green soap up to the edges of the wound. Grease and dirt are removed with benzine or ether. The skin is cleansed with iodine and alcohol, severed nerves and tendons are repaired and primary suture of skin is effected.

Infected. The wound is packed with moist saline gauze for forty-eight hours. Sulfathiazole powder may be added locally. Healing occurs by secondary intent.

3. *Puncture.* Cauterization of the tract with evacuation of the underlying hematomas, when present, is carried out.

4. *Lacerated. Contaminated:* Multiple superficial wounds due to peppering with tiny fragments of low velocity, as hand grenades and buck shot, are a combination of shallow puncture and lacerated types and may not require surgery.

Perforating wounds with small entrance and exit openings are usually the result of long range rifle bullets, sharpened or high velocity bullets. Bullets may traverse bone

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and joint leaving a simple tunnel with no foreign bodies, clothing or débris remaining in the wound. Simple immobilization of the limb in plaster may be sufficient treatment.

Penetrating and perforating wounds require mechanical cleansing. Treatment of these wounds consists in thorough mechanical cleansing under anesthesia, general or regional, without further traumatizing or contaminating the field. Infiltration anesthesia should never be attempted, since it means infiltration of dirty, infected and traumatized tissue, with further devitalization of the part.

A blood pressure cuff inflated to about 200 to 250 mm. of mercury will control bleeding of the upper extremity and enable proper visualization. The tourniquet should be applied for the lower extremity with just enough pressure to shut off arterial pulsations.

A dry shave should be given in hairy sections. The surrounding tissues should be carefully cleansed with a solvent and thoroughly washed with sterile water. The wound is covered with sterile gauze. Antiseptics are never poured into the wound, because of the creation of nonviable tissues which afford excellent culture medium for bacteria. Antiseptics may destroy some organisms but devitalize the tissues and therefore seriously impede the inflammatory response of damaged tissue which is so necessary in repair, and also impair the effectiveness of the natural defense mechanism of the soft tissues. Normal saline solution does not damage soft tissues and it allows tissue to vitalize defense against remaining organisms. Chemical antiseptics cause interference with repair of bone, presumably the result of devitalization of the osteogenic elements. The skin may be painted with an antiseptic up to the wound margins. The wound itself is then irrigated with copious quantities of normal saline.

Débridement. Drapes are changed and débridement is performed. Adequate exposure by incising skin in the longitudinal axis of the limb may be necessary. Useful instruments are a large scalpel and a large tissue forceps with multiple teeth. Crushed and devitalized margins of skin flaps are excised. A quarter of an inch margin of skin around the wound is ample. Avoid unnecessary transverse division of uninjured skin and muscle. All contaminated and nonviable tissues should be removed. All torn and devitalized bits of fat, muscle and fascia are excised. Remove the contents and walls of the track in penetrating wounds, as the wound track is lined by devitalized and necrotic tissues. This requires sharp dissection and the avoiding of injury to important nerves and vessels. Tubular excision of perforating wounds of the tunnel variety is carried out. Completely detached fragments of bone are to be removed, avoiding bone fragments which remain attached to the periosteum, especially if they are essential in providing continuity of bone tissue. Excision in mass of all torn, crushed, discolored and noncontractile muscle will be encountered. The excision may involve sacrifice of all that remains of a muscle or maybe a muscle group. Massive necrosis and infection will supervene unless muscles with compromised blood supply are removed. Open up the adjacent cellular spaces affected by the trauma and when necessary incise the soft tissues, following up the cellular spaces in the depths of the wound, always keeping in mind the need for adequate drainage. When deep cavities are present, drainage must be insured by opening up the aponeurotic planes and the intermuscular spaces. Thorough débridement will convert a potentially infected accidental laceration into a nontraumatized aseptic wound. (Facial wounds permit limited débridement.)

The removal of foreign bodies includes war missiles, soil, soiled pieces of clothing and detached bony fragments. The wound is to be thoroughly irrigated with a saline solution; many liters should be used. The wound should be retracted to expose its entire extent and depth.

Appraisal and Repair of Anatomical Structure. An inspection is made of the

wound with appraisal of the underlying anatomical structures and their altered physiological function. An accurate plan is determined for the immediate or subsequent treatment of the injury. In war wounds the repair of damaged tissues, repair of divided capsules and the suturing of divided nerves and tendons are consigned to a later time. Tendons and nerves can be tagged with black silk for future reference. Fractures are to be reduced.

Release of Tourniquet. After the tourniquet is released the bleeding vessels are ligated.

Chemotherapy. Implantation of sulfa drugs directly into traumatic wounds has lowered the incidence of infection.[3,4,5,11] Sulfonamides are very effective bacteriostatic agents and when applied to tissues cause no apparent damage to the cells and do not alter the normal course of repair of either soft tissue or bone; as a matter of fact, they aid repair by preventing infection. Five to 10 Gm. of sulfanilamide or sulfathiazole powder is sprinkled in the wound as a prophylactic measure. One Gm. is allowed for every ten square inches of wound surface. Avoid massive aggregations of the powder at one point. Administer sulfonamides orally—4 to 6 Gm.—followed by successive doses of 1 Gm. every four hours, or subcutaneously 10 Gm. of sulfanilamide powder dissolved in 1,000 cc. normal saline, at six-hour intervals.

Fresh wounds are closed in layers in civil practice. Primary suture is never used in lacerated gunshot wounds.[12] Tangential wounds with loss of covering tissue are skin grafted primarily, in civil practice. Gaping tension wounds are packed with vaseline gauze. Oozing may be controlled with a pressure sponge from without. War wounds call for open packing plus immobilization in position of optimum function. Packing gives support to the tissues from within, preventing edema, and replaces bulk of tissue removed.

The Carrel-Dakin treatment is instituted when total wound excision has been impossible. It encourages wound drainage and will encourage separation of sloughing tissues. It is also useful for sterilizing the surface of a wound prior to skin grafting. The disadvantage is having the patient bedridden.

Splinting and Elevation of Part. All wounds of the extremities are immobilized either in traction, splinting or casting—moulded plaster cast without padding. The closed plaster method provides rest for the extremity, prevents reinfection of the wound and is a dressing which allows pus and secretion to seep away without disturbing the granulation tissue. Indications for removal of plaster are pain, looseness and softening of the cast, secondary hemorrhage and foul smell.

Trueta[12] in his experience in the Spanish War claims the value of immobilization of a wounded limb in a complete plaster of paris cast: (1) Rest allows venous and capillary thrombi to form; (2) rest allows new capillaries to form which are not torn by repeated dressing of the wound; (3) plaster maintains a constant beneficial pressure on the wound; (4) the mixture of organisms on the wound may by their mutual antagonism prevent the victory of any one group; and (5) an uncovered deep wound produces dehydration and loss of heat.

Infected Wounds. The contaminated wound has gone on to the infected state. The bacteria from the soil, skin, clothing or intestine have multipled and have been destroyed by the forces mobilized by the inflammatory reaction. The character of the infection depends on:[8] number and virulence of the bacteria, the pathologic character of the inflammatory response to the host to the particular type of bacteria concerned, the blood supply of the contaminated part, and the amount of devitalized tissue in the area, immunity to the host, and the presence or absence of anatomic barriers which will confine the infection within a compartment.

Contaminated war wounds left untreated always go on to infection. Bacteria have multipled and invaded the lymphatics, and

the absorption of toxins results in clinical rise in pulse and temperature. Surgical procedures at this stage may become dangerous and produce spreading of the infection with severe general reaction.

TREATMENT

Chemotherapy is to be instituted depending upon the type of infection. Sulfanilamide is administered for streptococcal infections and sulfathiazole for staphylococcal and gas gangrene infections as follows: Initial dose 6 Gm. followed by 1 Gm. every four hours; this should be given every six hours for about one week. The open wound should be dusted with the sulfonamide powder.

Surgical therapy includes decompression of pus, excision of necrotic and dead tissue, and removal of foreign bodies.

Surgical Indications. These are localization with suppuration and fluctuation. In war wounds, there will be pain, swelling and tenderness along the wound track. Thin, foul, sanguineous discharge is usually present in deep anaerobic infections. A spreading mottled bronzing discoloration of the surrounding skin requires removal of dead muscle tissue and foreign bodies.

The Carrel-Dakin treatment of necrotic sloughing wounds in which surgery is contraindicated may be used. The removal of dead tissue will enhance the effectiveness of sulfonamide or zinc peroxide.

Compound Wounds. The soft tissues are treated in a similar manner to those surrounding simple lacerated wounds, namely, mechanical cleansing, saline irrigations plus débridement.

All traumatized muscles, fascia and skin edges are excised. Blood clots are evacuated. Loose, small bone fragments are removed and soiled bone surfaces are excised. Complete hemostasis is desired. Continuous irrigation with large quantities of saline solution is carried on throughout the procedure. Chemotherapy is applied locally, supplemented by oral doses of 5 to 8 mg. per 100 cc. for prophylactic effect.

Traction and manipulation are carried out to reduce the fracture; skeletal traction may be necessary. Internal fixation is used in some clinics.

Surgeons differ as to the best method of closing a wound, the common methods employed are: Immediate closure with no drainage is to be attempted only in civil practice. War wounds are never closed by primary suture. Primosecondary suture may be brought together after forty-eight to seventy-two hours.

Orr-Trueta Treatment. This is a combination of the Orr treatment of osteomyelitis and the Boehler treatment of fractures. Treatment and débridement is to be followed by reduction and retention of fracture, by means of a plaster of paris splint encased in circular plaster. Primary suture or wounds are packed with vaseline gauze, sulfanilamide paste gauze or 12 per cent lactose solution gauze. This prevents secondary introduction of pathogenic bacteria and also forms a barrier against spreading infection.

Carrel Dakin tubes are used with open wounds and are advisable in those cases in which wound excision has been incomplete. It is more valuable in sloughing wounds, as it encourages wound drainage; but this requires adequate facilities and observation.

Retention is best accompanied by fixation of all parts so that there is perfect control without constriction or pressure. This is usually accomplished by plaster of paris cast. Aftercare is essential to maintain such control and to protect against secondary infection.

SUMMARY

In conclusion we are offering an outline with a view to simplifying the approach to the treatment of traumatic wounds, which we believe will be helpful in civil and military practice.

1. Abraded
2. Incised—contaminated, infected
3. Puncture
4. Lacerated

A. Contaminated:
(1) Multiple superficial wounds
(2) Perforating (through and through)
(3) Penetrating and perforating
Mechanical cleansing
Copious saline irrigation
Débridement—skin, muscle, devitalized bone
Removal of foreign bodies
Saline irrigation
Appraisal and repair of anatomical structure: nerves and tendons; fractures
Release of tourniquet
Chemotherapy
Wound closure—primary, primary secondary, open with packing
Splinting and elevation of part

B. Infected:
Chemotherapy
Surgical
Chemical

5. Compound
Saline irrigation
Débridement
Reduction of fracture
Wound closure
Fixation
After care

REFERENCES

1. Bailey, Hamilton. Surgery of Modern Warfare. Vol. 1, p. 67. Baltimore, 1941. William & Wilkins Co.
2. Bisgard and Baker. Treatment of fresh traumatic and contaminated surgical wounds. *Surg., Gynec. & Obst.*, 74: 20, 1942.
3. Campbell, W. C. and Smith, H. Fresh compound fractures. Treatment by sulfonamides. *J. A. M. A.*, 117: 672, 1941.
4. Jensen, N. K., Johnsrud, L. W. and Nelson, M. C. The local implantation of sulfanilamide in compound fractures. *Surgery*, 6: 1, 1939.
5. Key, J. A., Frankel, C. S. and Burford, T. H. The local use of sulfanilamide in various tissues. *J. Bone & Joint Surg.*, 22: 952, 1940.
6. Koch, Sumner L. The primary treatment of wounds. *Minnesota Med.*, 24: 747, 1941.
7. Kreuscher, Philip, H. The treatment of fresh wounds. *Am. J. Surg.*, 51: 573, 1941.
8. Lockwood, J. S. *Surg. Clin. Nortn America*, 21: 1739, 1941.
9. Mason, Michael S. Wound healing. *Illinois M. J.*, 78: 523, 1940.
10. Reid, M. R. and Carter, B. N. The treatment of fresh traumatic wounds. *Ann. Surg.*, 14: 4, 1941.
11. Tendler, M. J. Sulfanilamide in surgery. *J. Tennessee M. A.*, 33: 300, 1940.
12. Trueta, J. Treatment of War Wounds and Fractures. P. 22. New York, 1940. Paul B. Hoeber.

DIFFERENTIAL DIAGNOSIS BETWEEN THYMIC DUCT FISTULAS AND BRANCHIAL CLEFT FISTULAS*

REPORT OF A CASE OF BILATERAL AURAL FISTULAS AND BILATERAL THYMIC DUCT FISTULAS

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SEVERAL types of cysts and fistulas are encountered in the neck. These are the well known midline lesions such as thyroglossal, dermoid, and the lateral cysts and fistulas of branchiogenic origin, and the hygromas.

Although many cases of congenital lateral cervical fistulas and auricular fistulas have been reported in the literature, it is rare to find a case which presents the picture of both bilateral thymic duct fistulas and bilateral branchial fistulas. Hyndman and Light,[1] in 1929, reported a case of a colored boy, age four, who illustrated this rare finding. This paper presents a similar case. In addition, the case illustrates that lateral cervical fistulas may be the remnants of true thymic duct fistulas and gives us the opportunity to differentiate those lateral cervical fistulas and cysts that have their origin in true pharyngothymic duct from those whose origin is the branchial clefts, and/or pouches.

CASE REPORT

A negress, R. S., age twelve, was first seen in the out-patient department of the Los Angeles County General Hospital, complaining of bilateral draining sinuses in the neck and at the ears. All four openings had been draining periodically since birth. She had bilateral fistulous openings along the anterior border of the sternomastoid muscles at the middle third, and over the anterior border of the ascending limb of the helix of both ears. (Figs. 1 and 2.) The findings otherwise were negative, except for a very low mentality and difficulty in talking.

A diagnosis was made (1) of bilateral true congenital auricular fistulas, coming from the first branchial groove and, (2) bilateral pharyngothymic duct fistulas, originating from the third branchial pouch.

On December 30, 1941, under anesthesia, the lateral neck tracts were excised after the tract had been injected with methyl blue. The incisions were made along the course of the anterior border of the sternomastoid muscles, first on the right and then the left. On the right side, the tract ended abruptly at a level of the hyoid bone. On the opposite side, it passed in the classical manner, under the anterior portion of the sternomastoid, over the jugular vein and under the facial vein. At the middle portion of the posterior belly of the digastric muscle it arched medially, ending in the pharynx just below the tonsil. After dissection was carried beyond the digastric muscle, all but a stump of the tract was removed and a probe passed into the lumen, suturing the same securely and then pulling the probe and tract into the pharynx where the then inverted tract was ligated intra-orally. The wounds healed *per primum*.

The excision of the auricular fistulas was performed on January 13, 1941. Both tracts followed along the external auditory canal to the vicinity of the tympannic membrane, where both ceased. The postoperative course was uneventful, except for a short period of purulent drainage from the right ear. The child was again seen December 5, 1941, at which time keloids had formed at the scars, but there had been no recurrence of drainage.

The pathologist's findings were as follows: (1) The lateral neck fistulas (Fig. 3): Microscopic sections show the lumen containing desquamated epithelium and collections of cells, mostly lymphocytes. The lumen is lined by respiratory-like epithelium. (2) The auric-

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ular fistulas (Fig. 4): Microscopic sections show hair follicles, stratified squamous epithelium with keratinization and papillae. The lumen contains desquamating cells and cornified layer. Sebaceous glands are also seen.

FIG. 1. View showing fistulous opening along the middle third of the anterior border of the right sternomastoid, and over the anterior border of the ascending limb of the helix of the right ear.

FIG. 2. View showing fistulous opening along the middle third of the anterior border of the left sternomastoid, and over the anterior border of the ascending limb of the helix of the left ear.

CLINICOPATHOLOGIC CORRELATION

The clinical manifestations of lateral cervical cysts and fistulas are varied and may be seen at any age or in any race. Hyndman and Light (1929), in a collection of ninety cases, found that the average age at which these patients came to the doctor is twenty-one. The range varies from three weeks to forty-eight years. Usually, the cyst is first noticed when it reaches the size of a small egg. In the ninety cases, 84 per cent of the total were unilateral; 52 per cent being on the right and 32 per cent on the left. The remainder were bilateral. The cyst may be painless but fluctuant, and the patient may give a history of variation in size in previous years. The cyst is usually located in the anterior triangle of the neck; but although it may be at any level, it is usually opposite the middle third of the sternomastoid. The cyst may have no opening, or it may become a fistula with either an internal opening into the pharynx, or an anterior opening externally on the anterior border of the sternomastoid; or there may be both internal and external openings. The patient may have noticed discharge, often of a sticky mucoid consistency, either into the pharynx or onto the skin through the external opening.

As to the origin of lateral cervical cysts and fistulas, there has been much discussion and disagreement. Wenglowski,[2] who probably did more exhaustive work in tracing the pathogenesis of these lateral lesions than any other person, shows that early in the development of the embryo there is a lateral out-pocketing from each of the third branchial pouches. Each of these tubular-like structures descends into the mediastinum and there takes part in the development of the thymus gland. The epithelium lining the duct is ciliated and resembles respiratory epithelium. But as the duct passes downward, its lateral wall comes in close contact with the stratified squamous epithelium of the cervical sinus. The cervical sinus is the result of the rapid overgrowth of the first and second branchial arches in such a manner that they

overlap and override the remaining branchial arches, and so form an overhanging roof to the remaining branchail clefts, much like the operculum in fish. The mesochymal wall between the cervical sinus and the thymic duct becomes very thin and the squamous epithelium lining the cervical sinus becomes part of the wall of the thymic duct. Because of this, both squamous and ciliated epithelium are found in certain lateral cervical fistulas. As further development takes place, islands of lymphocytes appear which invade and surround the duct and form the anlage of the thymus gland. In microscopic sections of remaining branchial clefts, both areas of packed lymphocytes and follicles are found, and also, but rarely seen, are true Hassall's corpuscles. This observation has been offered as additional proof that so-called

Fig. 3.

Fig. 4.

Fig. 3. Microscopic section of lateral neck fistula, showing respiratory-like epithelium and collections of lymphocytes, but showing no vestiges of skin.

Fig. 4. Microscopic section of the auricular fistula, showing hair follicles, stratified squamous epithelium, and sebaceous glands, characteristic of true branchial groove fistulas.

branchial fistulas are actually the remains of the thymic duct.

The course of the fistula is also a clue to its possible origin. The course of the thymopharyngeal duct, because of its origin from the third branchial pouch, must be anterior to the carotid sheath and must have its origin in the infratonsillar fossa. In most cases of lateral fistulas, just this relationship exists. A fistula that has its origin in the second branchial pouch or cleft, would have to follow other courses, and would have to pass between the internal and external carotids, as pointed out by Malcolm and Benson.[3] Furthermore, a fistula having its origin solely in a branchial groove would contain vestiges of skin and according to Meyer[4] would have to be above the level of the hyoid bone.

Those who differ with Wenglowski, point out that this lateral cervical lesion may be the remains of either branchial groove, or branchial pouch and not necessarily be a remnant of the thymic duct. Fistulas have been found that may very well come from the second branchial pouch; having origin in the supratonsillar fossa and instead of being ventral to the carotid sheath, pass between the internal and external carotids. To explain both the presence of ciliated and stratified epithelium, it is pointed out that a lateral cervical fistula may be made up of a persistent branchial cleft and corresponding branchial pouch with perforation of the closing membrane between them. The ciliated pseudorespiratory epithelium comes from the branchial pouch, and the stratified squamous epithelium is derived from the cleft. The presence of packed bands of lymphocytes and even lymphocytic follicles may be due to the almost universal infection of these fistulas.

Lastly, some have stated that lateral anomalies may be due to a persistence of the cervical sinus with or without connection with the branchial apparatus.

The possibility of the fourth branchial apparatus playing a part in the development of congenital lateral cervical fistulas, may be dismissed by pointing out that since the arch of the aorta comes from the fourth arch, the fistula if derived from this arch, would have to course below the subclavian vessels on the right, and arch around the arch of the aorta on the left. There has been no such case reported, as far as we know, in which such a course has been described.

The auricular fistulas are more common than lateral cervical fistulas and may be present all during life without being noticed, except for a possibly small, dimple-like depression located on almost any part of the ear. The fistula or cyst may become infected and drain offensive discharge. If the secretions are retained, the cyst may become enlarged and tender, and at times, the infection may extend forward and an abscess be formed a short distance away from the fistulous opening. The anterior auricular lymph-node may become involved, swollen and tender. Once these cysts are infected, the tendency for remissions and recurrence of the infection is great.

As to the origin of the not uncommon auricular cysts or fistulas, there is very little disagreement. In general, two theories have been advanced. The first state that they are the result of malformation of the first branchial cleft. The second points out that early in the life of the embryo, six small nodules appear derived from the first and second branchial arches and surround the first branchial cleft. These rounded nubbins give rise to the various parts of the pinna. In the process of fusion of these nubbins, cysts or fistulas may develop. These are all derived from ectoderm and are lined with normal skin, including all the accessory structures such as hair follicles, sebaceous and sweat glands. (Fig. 4.) Studies of reconstructed models of various aged embryos seem to bear out the latter explanation.

The surgical technic for treatment of lateral cervical fistulas has been reviewed in a previous paper published by one of the authors (C. J. B.) in 1933.[5,6]

SUMMARY

The case herewith presented represents both the true branchial fistula, which affords an opportunity for clarification of a still greatly confused differential diagnostic problem.

For purposes of clarification, those lateral neck fistulas occurring below the hyoid in a definite relations to the sternomastoid and the carotid sheath, should almost without exception be called pharyngothymic duct fistulas and cysts, coming from the third pouch, rather than branchial cysts and fistulas. Those above the hyoid may or may not be of thymic duct origin.

True branchial cleft affairs are found in the area above the hyoid and should contain vestiges of skin such as sebaceous glands, sweat glands and hair follicles. Most of these originate from the first groove and terminate somewhere in the vicinity of the tympannic membrane.

Branchial fistulas do rarely originate from the second pouch, and would have to descend between the internal and external carotid arteries.

REFERENCES

1. Hyndman, Olan R. and Light, George. The branchial apparatus. *Arch. Surg.*, 19: 410–452, 1929.
2. Wenglowski, R. Ueber den Halsfisteln und Cysten. *Arch. f. klin. Chir.*, 98: 151–208, 1912.
3. Malcolm, R. B. and Benson, E. R. Branchial cysts. *Surgery*, 7: 187–203, 1940.
4. Meyer, Herbert Willy. Congenital cysts and fistulae of the neck. *Ann. Surg.*, 95: 1–26, 1932. Congenital cysts and fistulae of the neck. *Ann. Surg.*, 95: 226–248, 1932. Footnote 3. True branchiogenic cyst and fistula of the neck. *Arch. Surg.*, 35: 766, 1937.
5. Baumgartner, Conrad J. Branchial and thyroglossal duct cysts and fistulae in children. *Surg., Gynec. & Obst.*, 46: 948–955, 1933.
6. Baumgartner, Conrad J. Lesions of the neck. *J. A. M. A.*, 113: 1860–1864, 1939.

HUMAN RED CELL CONCENTRATE FOR SURGICAL DRESSINGS*

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IN the processing of blood plasma it is well known that over half of the whole blood withdrawn is discarded. It occurred to one of the authors (J. J. M.) that this red cell discard might serve a useful purpose as a wound dressing for raw and potentially infected surfaces, and the first clinical usage of the product on April 28, 1942 was at the New York Post Graduate Hospital in the case of a knee joint arthrotomy torn apart by a delirious patient. The tendency for infection to develop in the knee joint is well known, as is the unfavorable reaction of the synovial lining to antiseptics. In this case, the incision was approximately nine inches in length and the interior of the joint was fully exposed. Red cells of semiliquid consistency were placed in the joint until they overflowed the cavity. On alternate days the same procedure was repeated, and on each occasion, a massive gauze and cotton dressing was applied. After several applications, co-aptation with flamed adhesive was started and step by step the entire incision was thus closed. There was no unfavorable reaction locally or systemically, but instead the wound margins took on a healthy appearance and there were no excess granulations. This patient recovered with a movable knee.

The second case, extensive burns of both lower extremities, was a patient of Dr. Harry V. Spaulding under treatment at the Reconstruction Hospital Unit of the Post Graduate Hospital. There was a profuse purulent exudate and the patient's general condition was very poor. Treatment was undertaken by Dr. Spaulding based on the favorable outcome of the case just mentioned. The burned area of one thigh was cleansed with saline under intravenous anesthesia, and then the red cells were liberally applied to the entire test area so that the coverage resembled a coating of red paint. Response was so prompt and satisfactory that the same procedure was later adopted for the opposite thigh. The purulent exudate rapidly subsided under the painless film-like protective. Granulations were smooth and healthy and the patient's general state markedly improved so that massive grafts were later successfully applied. The outcome in this patient was outstanding, notably because many other types of treatment had been tried in vain.

In addition to these two cases, several others of lesser importance have been treated by our confreres at the Post Graduate Hospital and elsewhere.

In the group, are postoperative infections, and two resistant ulcers of the leg. The striking features appear to be the following: (1) Subsidence of purulent secretion; (2) smooth healthy granulations; (3) impervious veneer coverage preventing fluid loss and re-infection; (4) painless application, and (5) conversion of a waste product into a useful agency.

Burns, infected and non-infected wounds, and certain types of ulceration have been benefited in our limited experience. It has been used for an osteomyelitis of the carpus quite recently but the outcome cannot at this early date be stated.

This red blood cell concentrate was prepared from blood of healthy donors withdrawn under sterile precautions by a closed system in 5 per cent sodium citrate. This

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was then centrifuged at 2,000 revolutions per minute for three-quarters of an hour and allowed to stand in a refrigerator at 3 to 5°C. After seven days the supernatant plasma was removed by a closed system. The cells of four individuals without regard for their blood groups were pooled and then returned to the refrigerator. Ten to twenty days elapsed from the time of the phlebotomy before the material was used. It was then quite viscid and had the consistency of thin red paint.

The total protein content was about 35 Gm. per 100 ml. with an albumin-globulin ratio of about 2:1. The hemoglobin content was 29 Gm. per 100 ml. The red blood cell count was approximately 8,000,000 per cu. mm. The leucocyte count 5,000 per cu. mm. with 1 per cent polymorphonuclear neutrophiles, 90 per cent lymphocytes and 9 per cent monocytes. Bacteriological examination showed the material to be sterile.

Many problems for further investigation immediately present themselves. Is it better to paint or spray the lesion and allow the material to dry into a crust or to use it as a wet dressing? Is it better to prevent evaporation and keep the dressing continuously moist or to allow it to dry? Is it better to use the material after actually hemolyzing all the cells or to omit this process? Is it better to use it as a fluid or to dry the material and use it as a powder? Is there any advantage in using cells of the patient's own blood group? It is too early definitely to answer these questions. These and others are, however, under investigation, including the addition of sulfa drugs and other antiseptics.

Several theories to explain the results obviously present themselves. Perhaps it acts as an occlusive and reduces oozing and re-infection. The very high protein content of the material may play a rôle. There may be some specific element which in this concentrated form is of value; or the products of destroyed and disintegrated cells may stimulate cell reproduction. Certainly leucocytes as living functioning phagocytes have disappeared, and likewise plasma with its contained antibodies are absent.

It is recognized that the number of patients treated is small; but because of our satisfactory experiences this preliminary report is presented with the hope that others will be stimulated to use this mode of therapy in an attempt to evaluate it. If these initial successes are substantiated, this hitherto discarded product will be of considerable value in treating war and other casualties.

Case Reports

BENIGN TUMORS OF THE MALE BREAST

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TUMORS of the male breast are uncommon, comprising only approximately 2 per cent of all neoplasms affecting the breast. Due to the relative rarity of the lesion as compared with tumors of the female breast, reports on the subject are so infrequent that we have been prompted to describe the cases seen at this hospital since its organization. The pathological and therapeutic significance of lesions of the male breast become real and not apparent where the patient-population of a large hospital is exclusively male.

During the seventeen-month period from October 18, 1940, to March 26, 1942, there were 29,128 admissions to the Station Hospital, Camp Shelby, Mississippi. Of this number twenty were admitted for complaints referable to the breast, an incidence of one breast lesion in each 1,456 admissions. All of the lesions were benign and all occurred in white patients except one (Indian); three were inflammatory in character and seventeen were abnormal growths. One neoplasm, one cystic dilatation of a duct, and fifteen cases of simple hypertrophy composed the non-inflammatory group of cases. De Cholnoky,[1] in reporting a series of 102 benign tumors of the male breast, found thirty-five inflammatory lesions, thirty-six fibromas or fibro-adenomas, three gynecomastias and one lipoma. No cystic lesions were noted in his series. The inflammatory lesions were all abscesses and are tabulated in Table 1. In the non-inflammatory group of cases the three different pathological entities encountered, namely, lipoma, cystic dilatation of a duct and gynecomastia, will be discussed in detail.

Table 1 lists in concise form the breast lesions seen at this hospital since its organization.

Finney, as quoted by Guy,[2] states that pure lipoma of the breast proper is one of the rarest tumors regardless of age. White,[3] in 1927, described a lipoma of the left breast that occurred in a white male carpenter, age sixty-four. A history of forty years' duration of the tumor was obtained from the patient. Guy also reported a case of lipoma in a white male, age four and one-half years. However, White's case is the only one found in a brief search of the literature similar to the case herein reported.

CASE REPORT

Pvt. S. J. B., age twenty-five, Hospital Register No. 11,842 (Case No. 3, Table 1), was admitted to Station Hospital, Camp Shelby, Mississippi, May 31, 1941, with the chief complaint of tumor of the left breast. The soldier stated that in 1922, at the age of six, he fell and bruised his left breast. Soon after the accident he noticed a swelling in this region. The left breast gradually enlarged from the onset until the present time. The patient had never noticed any discharge from the nipple and only occasionally had he noticed soreness in the left breast. There was no complaint other than the one described above. The soldier's family history, to his knowledge, was negative for a similar condition in any of the male members.

The physical examination revealed a well developed and well nourished white male with no abnormal findings except for an apparently normal female breast on the left side. Examination of the left breast revealed a large soft mass about the size of a grapefruit. No lumps or tender areas were noted and there was no discharge from the nipple. The underlying structure did not appear to be attached to the chest wall or to the skin superficial to the mass. When the patient contracted the pectoral muscles of the left chest wall the tumor mass could be seen to divide into quadrants.

All laboratory tests, including blood serology, urinalysis, and *x*-ray of the chest were within the limits of normal. On June 12, 1941, left mastectomy was done under gas-oxygen-ether anesthesia. The patient's postoperative convalescence was uneventful. The wound healed by primary union.

TABLE I

Case	Initials and Hospital Register Number	Age	Breast	Duration of Symptoms	Trauma	Operation	Diagnosis
1	S. T. L. 999	23	Left	10 days	Yes	Incision and drainage	Abscess
2	J. C. F. 8,636	18	Left	5 months	No	Excision of mass	Gynecomastia
3	S. J. B. 11,842	25	Left	19 years	Yes	Mastectomy	Lipoma
4	F. B. 13,242	21	Right	2 years	No	Mastectomy	Gynecomastia
5	G. F. H. 13,961	22	Left	6 years	Yes	Mastectomy	Gynecomastia
6	E. A. D. 14,837	34	Left	13 years	No	Mastectomy	Cystic dilatation of duct
7	D. Y. M. 15,035	19	Left	4 years	No	Mastectomy	Gynecomastia
8	J. C. R. 17,119	24	Right	3 months	Yes	Mastectomy	Gynecomastia
9	N. B. G. 18,121	22	Left	5 years	No	Mastectomy	Gynecomastia
10	W. P. S. 19,958	23	Right	6 months	No	Mastectomy	Gynecomastia
11	D. L. K. 20,143	25	Right	2 months	No	Mastectomy	Gynecomastia
12	J. D. M. 20,218	23	Right	1 year	No	Mastectomy	Gynecomastia
13	K. D. T. 20,302	24	Left	15 years "All his life"	No	Mastectomy	Gynecomastia
14	J. B. M. 21,028	24	Right	"Pain 2 years" Mass 3 months	No	Mastectomy	Gynecomastia
15	C. T. W. 23,147	22	Left	1 week	No	Incision and drainage	Abscess
16	J. C. F. 24,066	18	Left	13 months	No	Mastectomy	Gynecomastia
17	O. K. A. 25,640	27	Right	10 years	No	Mastectomy	Gynecomastia
18	R. H. F. 26,280	26	Right	1 week	Yes	Incision and drainage	Abscess
19	R. O. M. 27,020	32	Right	2 weeks	No	Mastectomy	Gynecomastia
20	J. J. S. 29,128	22	Right	3 years	No	Mastectomy	Gynecomastia

Pathological examination revealed the tumor to weigh 1,090 Gm. It was 23 cm. long, 15 cm. wide, and 10 cm. thick. It was bluntly triangular in shape and had a lobulated appearance. It was firm and well encapsulated. The capsule of the mass was somewhat mottled and

translucent. On cross section the parenchymatous tissue was of a lemon-yellow color. The cut surface was covered by a fine, dewdrop-

FIG. 1. Case III. It is noted in the above photograph that the patient is distinctly masculine except for left breast.

like deposit composed of minute fat droplets. There were strands, pink in color, and varying in thickness and length, traversing the fat matrix. *Microscopic:* The bulk of the tissue was composed of fat cells. They surrounded strands of striped muscle bundles. Apparently the muscle bundles were separated from each other by the increasing deposit of fat tissue. There was no evidence of malignancy. Diagnosis: Lipoma, replacing voluntary muscles.

White's description of the clinical features of the lesion in his patient is strikingly similar to our case in one respect: "The skin is everywhere freely movable over the tumor and the tumor over the deeper structures, when the left pectoral muscle was tensed, the tumor rose up, stood forward and became less movable as if attached to the pectoral muscle"; in our case, "When the patient contracted the pectoral muscles of the left chest wall the tumor mass could be seen to divide into quadrants." This observation led us to suspect that the lesion was not simple hypertrophy but neoplastic, as the reaction of the tumor, when the left pectoral muscles were tensed, showed an abnormal attachment to the chest wall.

Cystic dilatation of a duct was found only once and should not be confused with cystic disease of the breast in the female which is known by almost as many names as there are authorities who have described the condition. The lesion occurred in the left breast of an Indian patient, age thirty-four, who gave a history of thirteen

FIG. 2. Photomicrograph of tissue from left breast, Case III, showing "fat cells" between striated muscle fibers (pectoralis major muscle).

years' duration. There was no trauma incident to the onset of the growth, to the patient's knowledge.

According to Boyd,[4] the most common type of large cyst is what Bloodgood describes as "blue-dome cyst" and may be seen at operation after the subcutaneous tissue has been divided. In our patient, although the cyst was only one dilated duct, the "blue-dome" was quite visible through the skin beneath the nipple. On inspection, it appeared to be about the size of a half-dollar.

CASE REPORT

Pvt. E. A. D., Indian, age thirty-four, Hospital Register No. 14,837 (Case No. 6, Table 1), was admitted to Station Hospital July 31, 1941, with the chief complaint of enlargement of the left breast. The soldier stated that he first noticed a small lump in his left breast in 1928. The mass made its appearance without trauma and had gradually increased in size since onset. There had never been any discharge from the nipple and no pain was associated with the lesion.

The general physical examination was noncontributory except for a dark skin over entire body and enlargement of the left breast.

FIG. 3. Case VI. Gross appearance of cystic mass of left breast.

On examination of the breast a mass about the size of a lemon was located just beneath the left nipple. The tumor appeared to be cystic to the palpating hand and was attached to the skin. The skin over the "fluid" or mass was very thin and there was a bluish discoloration present.

Laboratory tests completed, including *x*-ray of chest, complete blood picture, urinalysis, and blood serology, were all found to be within the limits of normal. On August 7, 1941, left mastectomy was done. The breast was removed by means of two transverse curvilinear incisions. The nipple was sacrificed because of the attachment of the tumor to the nipple and skin beneath the nipple. The operative recovery was uneventful and the wound healed by

FIG. 4. Photomicrograph of cystic mass, Case VI, showing wall of the cyst proper. The section of skin containing pigment is not shown in the field.

primary union. The patient was discharged to duty on the twelfth postoperative day.

Pathological examination revealed the specimen to consist of an elliptical section of white skin 8 by 5 cm. and the underlying mass of fibrofatty tissue, size 9 by 6 by 3 cm., 2 cm. from one end and 1 cm. from one border was the nipple. A cystic mass 4 cm. in diameter was seen and felt in the breast below and medial to the nipple. This mass had a "bluish" color when viewed through the skin. On section the cyst was found to be unilocular and filled with flakes of caseous material and cloudy gray fluid. *Microscopic:* Examination showed the skin with coil glands, sebaceous glands and hair follicles. The subcutaneous tissue at one end of the specimen merged with the cyst wall. At the other end a collection of fat was interbound between skin and the cyst. The cyst wall was composed of stratified squamous epithelium without skin appendages or rete pegs. The cells in its deeper layers were cornified and sloughing off. In the deeper layer of the cyst lining were masses of inflammatory cells. There was no evidence of malignancy. Diagnosis: Cystic dilatation of large duct of breast, left.

Fig. 5. Case VII. Simple hypertrophy of left breast.

Gynecomastia is an enlargement of the male breast simulating in size and appearance a virgin female breast. The fundamental difference in structure between the male and female breast is that in the former there are no acini, but only a series of ducts of fair size. The pathologist tells us that the condition is simple hypertrophy of the tissues present and is not neoplastic. The microscopic appearance of gynecomastia is very similar to the microscopic appearance of fibromas and fibro-adenomas of the male breast. In fibromas there are no acini but fibrous tissue about the ducts is abundant, while in fibro-adenoma there are two types, classified as pericanalicular and intracanalicular. In the former, according to de Cholnoky, fibrous tissue surrounds the ducts and acini forming definite circumscribed tumor masses, increasing in quantity and choking the

Fig. 6. Photomicrograph of breast tissue, Case VII, showing the ducts surrounded by dense layers of fibrous tissue.

epithelial cells. These cells undergo atrophy from pressure, deform, and finally disappear, so that nothing remains but fibrous areas arranged in concentric formation. Some of our cases showed exactly this pattern; and to illustrate that the two lesions may deceive even the elect, Case No. 2 in Table 1 is the same as Case No. 16. On the first admission only a small "lump" was removed from the lateral side of left breast; pathological diagnosis: gynecomastia. The lesion continued to grow, and nine months later mastectomy was done and the pathological diagnosis was fibro-adenoma. The intracanalicular fibro-adenoma are not so confusing as the fibrous tissues grow into the lumen of the duct pushing the epithelial lining before it. It would be interesting to know if any of de Cholnoky's thirty-six cases of fibromas or fibro-adenomas have recurred or if complete mastectomy was done at the time the original specimen was obtained. Charache[5] has stated that once gynecomastia develops it is persistent, and this assertion is partially substantiated by our one patient who was incompletely operated upon originally.

Trauma is mentioned very prominently by most authorities—de Cholnoky,[1] Charache,[5] Horsley,[6] and Christopher[7]—as the etiological factor responsible for the development of fibrous tumors and simple hypertrophy in the male breast. However, in our cases this has not been true. Of the fourteen patients with gynecomastias, twelve gave a history of "no trauma" to breast prior to onset or coincident with onset of symptoms; two gave a definite history of trauma. All suffered a dull, aching pain increased by the irritation of the military pack strap. The irritation of the pack strap caused the soldier to seek surgical relief. It may be suggested that the irritation was the trauma that produced the lesion; however, the tumors were all unilateral, nine in the right breast, five in the left breast, and the pack strap, when fitted properly, exerts equal pressure on each side of the anterior chest wall.

CASE REPORT

Pvt. D. Y. M., age nineteen, Hospital Register No. 15,035 (Case No. 7, Table 1), was admitted to Station Hospital August 4, 1941, with chief complaint of tumor mass in left breast. The soldier stated he had noticed a swelling in the left breast since the age of fifteen, his first year of high school. The "swelling" gradually enlarged to the present size. At times when he lifted heavy articles he suffered a dull pain in his left breast.

The general physical examination revealed nothing abnormal except enlargement of the left breast. On examination of the left breast a diffuse homogenous enlargement about the size of an orange was noted. No lumps or tender areas were present. The nipple was erect and there was no discharge therefrom. The axillary lymph-nodes were not palpable.

Laboratory reports, including urinalysis, blood serology, complete blood picture, and *x*-ray of chest were all within the limits of normal. On August 12, 1941, left mastectomy was performed through a crescent-shaped incision beneath the nipple.

Pathological report revealed the specimen to consist of a discoid mass of fibrofatty tissue 10 by 9 by 3 cm. The specimen was not covered by a membrane or capsule of any kind. It was composed of semifirm, pale gray tissue that resembled fibrous tissue in structure. There was nothing grossly recognizable as glandular tissue. The dense fibrous tissue was surrounded by a layer of fat. *Microscopic:* Examination showed a mass of very dense fibrous tissue containing relatively few neuclei. Scattered through the tissue were a few small lumps of glandular spaces, each lined by an irregular layer of columnar or cuboidal epithelial cells. The epithelial cells were adult in type and no mitotic figures were seen. Surrounding each gland space was a thin layer of relatively loose cellular fibrous tissue. A few ducts lined by epithelium similar to that already described were noted. Diagnosis: gynecomastia.

OPERATIVE TECHNIC

All of the cases have been handled in a similar manner. Mastectomy is done through a crescent-shaped incision beneath the nipple. The entire breast tissue is removed from the pectoralis fascia, taking precaution to conserve the nipple. If the

tumor is quite large, extensive dead space may be formed after its removal in which serum may collect. In this type of case a drain placed over the pectoralis muscle and brought out through a stab wound in the axilla has prevented the wounds from breaking down in any of our cases.

DISCUSSION

The etiology of gynecomastia and fibrous neoplasms of the male breast is obscure. Endocrine disturbances have been suggested as a basis for their development; however, in such an instance one would expect the lesion to be bilateral. Charache states that cases of gynecomastia have developed following prostactectomy. None of our cases had been previously subjected to this surgical procedure and none had any symptoms referable to the prostate. There was no complicating or co-existing disease in any of the cases of our series. Further, there was no evidence of glandular dysfunction; however, basal metabolism rates were not obtained in all of the cases.

Simple mastectomy is the treatment of choice for non-inflammatory tumors of the male breast no matter how innocent the lesion may appear, as it is well known that once gynecomastia develops the lesion remains permanently.[5] Further, carcinoma and sarcoma have both been observed to develop subsequent to gynecomastia and fibroma of the male breast.[5,8]

SUMMARY

1. Twenty benign lesions of the male breast have been reviewed.

2. One unusual case of lipoma of the male breast has been described in detail.

3. Trauma was found to be an etiological factor in only two out of fourteen cases of gynecomastia.

4. Average duration of symptoms prior to operation in the fourteen cases of gynecomastia was three and one-half years.

5. The lesion was found nine times in the right breast and five times in the left breast.

6. The etiology of gynecomastia is obscure.

REFERENCES

1. de Cholnoky, Tibor. Benign tumors of the male breast. *Am. J. Surg.*, 30: 298, 1935.
2. Guy, Chester L. Breast tumors in children. *Am. J. Surg.*, 33: 135, 1936.
3. White, Richard Joseph. An unusual case of lipoma of the pectoral region simulating gynecomastia. *J. A. M. A.*, 88: 1146, 1927.
4. Boyd, William. Surgical Pathology, 4th ed., p. 533. Philadelphia, 1938. W. B. Saunders Co.
5. Charache, Herman. Tumors of the male breast. *Surgery*, 7: 889, 1940.
6. Horsley, John S., Jr. Benign and malignant lesions of the male breast. *Ann. Surg.*, 109: 912, 1939.
7. Christopher. Textbook of Surgery, 2d ed., p. 889. Philadelphia, 1939. W. B. Saunders Co.
8. Neal, Pinson M. Malignant tumors of the male breast. *Arch. Surg.*, 27: 427, 1933.

THE SURGICAL TREATMENT OF INTRACRANIAL HEMORRHAGE COMPLICATING ECLAMPSIA

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THE occurrence of intracranial hemorrhage, either intracerebral or subdural, as a complication of eclampsia has not been recognized frequently in the past. In 1941, the author[1] reported a case of intracerebral clot complicating eclampsia in which surgical removal was rewarded with recovery. The basis of this report adds a subdural hematoma relieved by evacuation of the clot.

Eclampsia is a clinical entity which is not satisfactorily defined from either an etiologic or a pathologic point of view. Williams[2] states that eclampsia is an acute toxemia usually, but not always accompanied by convulsions. However, DeLee[3] remarks that this condition is not a disease but merely a symptom of some underlying cause, and he further mentions that cerebral hemorrhages of varying size frequently occur in eclampsia with this finding present in 40 per cent of autopsy material. Slemons,[4] in 1907, reviewed the literature to that date and Liebmann,[5] in 1925 quoted Schmorl's definition of eclampsia as "degenerative kidney changes particularly in the convoluted tubules where albumin and fatty alterations are observed: necrosis in the liver with thrombosis in the interlobular and intralobular vessels; degeneration in the heart, particularly in the muscles; hemorrhage and softening into the brain; and a widespread thrombosis in the internal organs."

Bell[6] more recently described a characteristic glomerular lesion of the kidney consisting of dilation of the glomerulus and thickening of the capillary basement membrane with narrowing of the lumen of the capillaries. Of the forty-six cases that have been reported, Slemons found the reports of seven and added two more in 1907. The next review was that of Schmidt,[7] in 1911, who brought the total to twenty-four. Caffier[8] found thirty-eight cases up to 1927 with four others that had been discarded because of incompleteness either of the history or of the autopsy. His paper brings the literature to that date. Since then, similar conditions have been reported by Liebmann, Pohl,[9] Bock[10] and Wronski.[11] Bock adds also the case of Berg and mentions three others as well as the case of Thalheimer which cannot be included because of lack of necropsy evidence. Knight,[12] in 1925, added a case in which there was hemorrhage into the frontal lobe, and King,[13] in 1933, reviewed the literature bringing the total to forty-six cases. However, only thirty are carefully analyzed in his report because of inadequate records. The age limit was from eighteen to forty-three years and the parity from primigravidity to tertiodeciparity, with a distribution of nineteen primiparas and eleven multiparas. Antepartum cases numbered fourteen, the earliest of which was at three months, and ten occurred during delivery and six during the puerperium.

These proportions are similar to those reported by Greenhill for the distribution of true eclampsia. Of these cases only fourteen showed true premonitory signs. This amazingly low figure makes the seriousness of the situation all the more apparent. It is not impossible that symptoms would have been observed in others had they been looked for, but this fact emphasizes again the necessity for the strictest watchfulness by those attending patients in confinement.

Headache was the most common symptom followed by vomiting and edema. Visual disturbances occurred in only seven instances and epigastric pain in six instances. Albumin in the urine was reported

fifteen times, and an elevation of temperature was observed in fifteen cases. In nine instances circulatory collapse was the first warning of anything abnormal, and in eight cases unconsciousness with or without cardiac signs ushered in the condition. The blood pressure records have not been carefully taken in all instances, particularly in the reports from Europe. The description of cerebral bleeding into the brain is the significant part of the pathologic condition which has been confirmed by these various reports. However, the type of hemorrhage will vary from a petechial to a massive hemorrhage into the frontal or occipital lobe on into the internal capsule, and in one case into the pons. One not infrequently sees this hemorrhage occur in the absence of convulsions, and Benda[15] believes that the increased capillary permeability is due to toxemia.

The two cases reported by Cronin and Knight are the only ones apparently in which recovery from massive hemorrhage occurred, and in neither instance did the patient have convulsions. King states that in nine cases exclusive of his report massive hemorrhage into one or the other parts of the brain is reported. These are the reports of various authors cited in his extensive review of the literature. The fact that such a condition occurs sounds a warning note to prevent or at least attempt to combat such a condition when it does occur.

The following report is the only one in which surgical removal of the clot has been rewarded by recovery of the patient:

CASE REPORTS

Case 1. Mrs. R. H., aged nineteen, had been seen at the antepartum clinic since October, 1940, by Dr. Eugene Penn. This was her first pregnancy and each time she visited the clinic her condition was satisfactory until March 10, 1941, at which time it was noted that she had gained 9½ pounds (4,300 Gm.) in the previous week, that her blood pressure had risen from 120 systolic and 80 diastolic to 130 systolic and 100 diastolic and that the urine contained a considerable amount of albumin. The patient stated that for four days she had suffered from a severe headache accompanied by spots before her eyes and that there was some swelling of her feet and legs. On March 13, she entered the hospital complaining of headache in the occipital region and was in labor that lasted for ten hours. Light ether anesthesia was administered and delivery of a normal boy weighing 8 pounds (3,630 Gm.) was effected by low forceps delivery. She was given 2 cc. of 50 per cent magnesium sulfate intramuscularly and 500 cc. of 20 per cent dextrose intravenously. After the anesthesia the patient remained stuporous, pale, cold and clammy. The pulse rate ranged from 120 to 140 a minute and the respiratory rate from 28 to 30 a minute; the blood pressure remained at 140 systolic and 102 diastolic.

At no time did she show any evidence of a convulsion. However, her pupils were dilated and did not react to light, and there was a homonymous hemi-anopia to the left with a slow horizontal nystagmus. Ophthalmologic examination revealed a 5 diopter choked disc on the right, 3 diopters on the left with a homonymous hemi-anopia.

Roentgenograms of the skull were negative and neurologic examination was negative except for the profound stupor. The temperature remained at 101°F., and the blood pressure at 140 systolic and 102 diastolic. The pulse rate was 60 a minute and the respiratory rate was 14 a minute. Examination of the urine revealed an acid reaction, the specific gravity was 1.024, albumin was 6.5 Gm., there were occasional pus cells and the blood urea nitrogen was 28 mg. per hundred cu. cm. Examination of the blood otherwise was negative, as was the Wassermann reaction.

Hypertonic dextrose was administered daily by venoclysis. She was referred to the neurological section of Iowa Methodist Hospital where a diagnosis of a lesion of the right occipital lobe was made and I believed that it was questionable whether this was the result of an intracerebral hemorrhage or a preexisting glioma with hemorrhage into the tumor. Two days later, under anesthesia of avertin with amylene hydrate, ventricular studies were attempted. Perforator openings were made over the occipital regions of the skull and when a trocar was passed into the right occipital lobe resistance was met at a depth of 3 cm. Aspirations from the trocar resulted in the removal of clots of old blood. A trocar was then passed into

the left lateral ventricle and clear fluid escaped under pressure. A total of 60 cc. of fluid was replaced with an equal amount of air, and roentgenograms revealed a shifting of the ventricular system to the left and a failure of filling of the posterior horn of the right lateral ventricle. An osteoplastic flap was then turned over the right occipital area and the brain was found to be under a significant increase of pressure with a flattening of the convolutions of the occipital lobe. The cortex was incised and a blood clot weighing 8 Gm. was removed.

After removal of this clot there was bleeding from the small branch of the posterior cerebral artery, which was controlled with electric coagulation. A sample of tissue taken from the surrounding area was examined by Dr. R. F. Birge, who stated that there was no evidence of tumor. The patient made a satisfactory recovery and on January 26, 1942, stated that she had no symptoms except an inability to see to the left. Her vision was 20/20 in the right eye and 20/25 in the left eye, and the choked discs had completely receded. However, there was a residual homonymous hemi-anopia on the left side. The blood pressure was 120 systolic and 80 diastolic and urinalysis was negative with blood urea nitrogen 14 mg.

A careful review of the literature revealed no evidence of subdural hematoma being recognized clinically as a complication of eclampsia, and in a review of 105 subdural hematomas in my experience there was no evidence of such a condition until the present case.

Case II. Mrs. A. T., a negress, age twenty, was transferred to the neurosurgical service of Mercy Hospital by Dr. I. H. Odell on November 11. Her second baby was born July 8th in Broadlawns General Hospital. The prenatal course was negative until she began to develop a moderate edema during the last two months of pregnancy. The blood pressure at the beginning of the sixth month was 98 systolic and 60 diastolic; it gradually rose and at the ninth month it was 128 systolic and 98 diastolic. There was a trace of albumin in the urine on the second of July and two plus albumin on July 8th, the day of delivery. On this day, the patient complained of severe generalized headaches and blind spells. The duration of the delivery was 3½ hours. Forty-five minutes after the delivery the patient had a clonic type of convulsion beginning in the hands and involving the entire body, lasting four minutes. The blood pressure on the date of delivery was 165 systolic and 100 diastolic; on the second day it was 180 systolic and 100 diastolic, and it gradually subsided until on the tenth day the blood pressure was 132 systolic and 80 diastolic. The urine was clear and her postnatal course was negative, and she was discharged on the eleventh postpartum day.

Approximately a month before her admission to Mercy Hospital on November 11, 1941, she developed severe headaches which required the administration of morphine and spinal puncture revealed increased pressure. The fluid was not examined at that time. She obtained relief until approximately a week before her admission to the hospital on November 11, 1941, when her headaches recurred with intense severity. Electro-encephalographic tracing revealed increased large delta waves over the right frontal and left occipital lobes. Neurological examination was negative. Spinal puncture revealed clear fluid under pressure of 30 cm. of water; cell count 7; total protein 30 mg.; colloidal gold 1110000000, Wassermann test of the fluid was negative. Pneumo-encephalography revealed a filling defect over both cerebral hemispheres in the frontal area, greater on the right than on the left. Under avertin anesthesia with amylene hydrate, an incision was made in the right superior temporal region and a perforator opening was inserted into the bone. The dura was discolored and under tension. When this was incised there was an escape of yellow fluid and old blood and following this the brain began to pulsate. There were similar findings on the opposite side.

The patient made a satisfactory recovery and when seen on January 19, 1942, there were no complaints. A careful inquiry revealed no history of previous injury.

CONCLUSION

Intracranial hemorrhage undoubtedly is a more frequent complication of eclampsia than has hitherto been realized and prompt recognition, with proper surgical intervention when indicated, may lead to complete recovery. These two cases are reported in the hopes that such a condition will always be borne in mind and that the patient with eclampsia will receive the benefit of

adequate ophthalmologic and neurologic consultation.

REFERENCES

1. Abbott, W. D. The surgical treatment of intracranial hemorrhage complicating eclampsia. *J. A. M. A.*, 117: 1439–1440, 1941.
2. Williams, J. W. Obstetrics. 6th ed. New York, 1931. D. Appleton & Co.
3. DeLee, J. B. Principles and Practive of Obstetrics. Philadelphia, 1938. W. B. Saunders & Co.
4. Slemons, J. M. Eclampsia without convulsions. *Bull. Johns Hopkins Hosp.*, 18: 338, 1907.
5. Liebmann, S. Eklampsie ohne Krämpfe. *Zentralbl. f. Gynäk.*, 49: 1906, 1925.
6. Bell, E. T. Renal lesions in the toxemias of pregnancy. *Am. J. Path.*, January, 1931.
7. Schmidt, H. H. Eklampsie ohne Krämpfe und ohne Bewistlosigkeit. *Ztschr. f. Geburtsch. u. Gynäk.*, 69: 143, 1911.
8. Caffier, P. Retrspecktive Diagnose auf Eklampsie ohne Krämpfe. *Med. Klin.*, 23: 162, 1927.
9. Pohl, R. Ploetzlicher Tod in der Schwangerschaft. *Zentralbl. f. Gynäk.*, 51: 1913, 1927.
10. Bock, A. Klinischer Beitrage zyr toedlichen Gestose ohne Krämpfe. *Zentralbl. f. Gynäk.*, 52: 102, 1928.
11. Wronski, M. Zur Eklampsie ohne Krämpfe. *Zentralbl. f. Gynäk.*, 52: 1528, 1929.
12. Knight, L. C. Eclampsia with cerebral hemorrhage in the puerperium. *Illinois M. J.*, 47: 53–54, 1925.
13. King, A. C. Eclampsia without convulsions terminating in cerebral apoplexy. *J. A. M. A.*, 100: 15–16, 1933.
14. Schmorl. *Arch. f. Gynäk.*, 50: 727, 1926.
15. Barrett, C. W. and Heager, S. B. A consideration of eclampsia with a case accompanied by hemiplegia. *J. Obst. & Gynec.*, 64: 463, 1905.

Salvation of the malignant uterus for purpose of future pregnancy is condemned in every particular.
From "Vaginal Hysterectomy" by James William Kennedy and Archibald Donald Campbell (F. A. Davis Company).

ACUTE PHLEGMENOUS GASTRITIS WITH MULTIPLE PERFORATIONS*

CASE REPORT

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ACUTE perforations as a first manifestation of gastric ulcer attain in some instances an incidence of 50 per cent. Acute simultaneous multiple gastric perforations, however, are much rarer, and as a first manifestation attain an incidence of only 11.1 per cent; for this reason alone they deserve a recording.

CASE REPORT

F. S., an eighteen-year old, white male of German parentage, was admitted from a New York City Hospital to Welfare Hospital on March 19, 1940. The patient was the second of two children. A brother, two years older, is said to be of normal development and in good health. As an infant, the patient was slow in development. Thus, although he spoke at one and one-half and walked at two years of age, his walking was cautious and slow. He tired easily and "fell over quickly" when brushed against or when caught off balance. The patient was a poor eater and always had sluggish bowels. He was subject to frequent colds. The only children's diseases recorded were measles and chickenpox. The family history was entirely irrelevant. At nine and one-half, the patient commenced to make the rounds of various city institutions because of a slowly developing progressive weakness of the lower extremities. For some six years prior to his last admission, the patient was unable to walk and had been hospitalized in various institutions, and finally transferred to Welfare Hospital.

It is of interest to note that the physical findings of this patient as recorded below do not differ in any essential respect from those recorded at a New York City hospital, three years prior. It might also be well to mention that during his stay at the latter hospital, the patient had some six attacks of "loose bowels, accompanied by anorexia, and in several instances by tachycardia, but without mucus or blood. These were easily controlled by simple astringents."

Physical examination upon admission revealed a red-haired, grey-eyed, wasted and markedly deformed white male, co-operative and apparently comfortable. The skull was somewhat deformed and teeth carious and indented. The lower jaw protruded so that the teeth could not be approximated. The spine was immobile, nontender, and showed a marked thoracolumbar scoliosis to the left with lordosis. The thighs were outwardly rotated and acutely flexed at knees and there were also equinovarus deformities of feet, so that the patient assumed an "Indian squatting" position. The elbows and knees could not be positively extended to a 90 degree position. There was marked atrophy of the trapezii, pectorals, and of the muscles of the shoulder girdle, back, arms, forearms, thighs and buttocks; while the muscles of the calfs and temporal regions appeared hypertrophied. The skin of trunk, arms, and face showed numerous melanotic papules as well as a mild acne vulgaris. The tongue was large (macroglossia) and its papillae hypertrophied. The pharyngeal tonsils were hypertrophied. The thyroid was not enlarged; the salivary glands appeared normal, and there was no adenopathy noted. The radials, carotids and femorals were small. The lungs and heart were essentially negative. The blood pressure was 110/78 and the pulse rate 90. There was little subcutaneous fat, and the spine and sacrum were palpable through the left abdominal quadrants. Liver, spleen, and kidneys were not palpable. The external genitalia appeared of normal development; anus and rectum showed

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no pathological condition. The deep reflexes were absent. The superficial reflexes were present but more active on the left side. Ab-

FIG. 1. Stomach. Large hemorrhagic area in cardiac end of stomach reaching almost to esophagus.

normal reflexes were not elicited. There were no signs of meningeal irritation. The sensory reflexes for pain, touch, temperature, etc., were normal. The patient retained some degree of motion of the fingers, shoulders and toes. He was able to turn his head weakly and at times barely to raise the extended head. He could not rise from the horizontal plane, and when placed in a sitting position he rested upon the left buttocks. The cranial nerves were uninvolved with the sole exceptions of the seventh (weakness of facial muscles) and the eleventh (weakness of trapezii and sternomastoids). Co-operation was good. There were no illusions, hallucinations or delusions. The patient was oriented as to time, place and person; he was able to do simple calculations and his memory was good.

X-ray examination showed the bones of the skull (inclusive of sella turcica) to be normal. The bones of the wrists and hands showed a marked degree of decalcification. The mandible revealed infected root fragments in the right molar region but otherwise no abnormalities. Atrophy and decalcification were also present in the bones of the shoulder girdle, of the legs, and of the lower ends of the femora. The lungs showed no pathological condition upon *x*-ray examination. The urine was negative. The blood showed: hemoglobin 96 per cent; red blood cells 3,896,000; white blood cells 8,650; sugar 69 mg. per cent; creatinin 2.4 mg. per cent. The blood Wassermann was negative. The diagnosis was pseudohypertrophic muscular dystrophy.

Apart from his disabilities, the course of this patient's illness was uneventful until July 4, 1940. Between that date and August 3, 1940, the patient had several episodes of "loose bowels." These apparently were of the same nature as that experienced by the patient on previous occasions. They were unaccompanied by tenesmus, abdominal tenderness, fever, mucus, or blood, and they were apparently easily controlled by astringents.

On August 3, 1940, however, the patient had an accession of abdominal pain centered about the umbilical region. On examination, he appeared pale and distressed; he was nauseated but did not vomit. Pulse was 72 and temperature normal. The patient localized the pain just above the umbilicus, and described it as a dull ache without radiation. The abdomen was soft; spasticity, tenderness, and distention were absent. The colon was readily outlined through the soft abdominal wall and contained large amounts of movable material, apparently feces. Rectal examination showed a flaccid sphincter, and the entire ampulla filled with moderately firm feces. Oil enemas and manual disimpaction followed later on by a few voluntary bowel movements resulted in apparent improvement, so that on August 5 and 6, the patient was free of pains, had no nausea, was hungry, and the abdomen remained soft and flat.

However, on the evening of August 6, the epigastric pains returned and were accompanied since the morning of August 7 by persistent vomiting of coffee ground material. When seen in surgical consultation with Dr. J. H. Morris on the same morning, the patient appeared acutely ill. The abdomen was moderately distended. There was slight generalized and marked epigastric tenderness. There

was a curious absence of muscle spasm and rigidity. The liver and spleen were not palpable. The liver dullness was obliterated and there was a shifting dullness in the flanks. Rectal examination at this time showed tenderness high up in the midline, and an abdominal *x*-ray plate revealed a pneumoperitoneum and marked elevation of the right diaphragm "secondary to perforation in the gastro-intestinal tract." The vomitus showed a four plus Benzidine, some red blood cells, and a trace of bile. The white blood count at this time was 20,450 (polymorphonuclears 69 per cent), the urine showed acetone and diacetic acid, temperature 100°F. and pulse 130. The preoperative diagnosis was perforated gastric ulcer and spreading peritonitis. Immediate laparotomy was agreed upon.

Cyclopropane anesthesia was used. On opening the peritoneum, the hiss of escaping gas was heard. There was a considerable quantity of free, thin, reddish-brown fluid.* All peritoneal surfaces showed signs of acute diffuse inflammation, and in many areas the peritoneum was lifted from its bed by small emphysematous bullae. The loops of the small intestine were collapsed. The stomach was enormously distended and contained a huge quantity of soft crepitant material as determined by palpation. Inspection of the stomach revealed two large areas of frank necrosis through which free blood and stomach contents were seen to ooze. One area of necrosis measuring about 6 cm. in diameter was situated at the lesser curvature, well above the pyloric region. The second area of necrosis was located on the greater curvature of the stomach at the junction of its lower and middle thirds. Its long axis was in the direction of this curvature. Part of the great omentum was plastered against this perforation and covered the same imperfectly. This was dissected away without difficulty and appeared

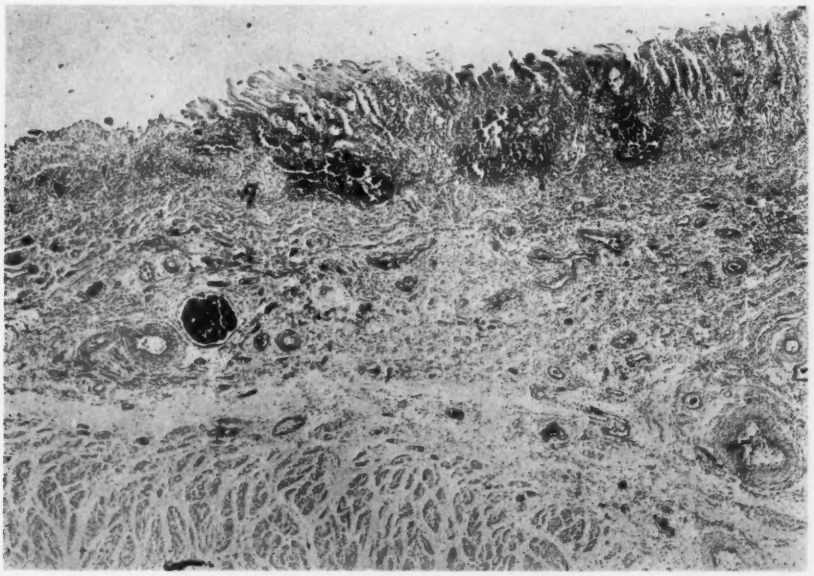

Fig. 2. Large masses of round cells extending through entire width of mucosa. Marked fibrosis at A.

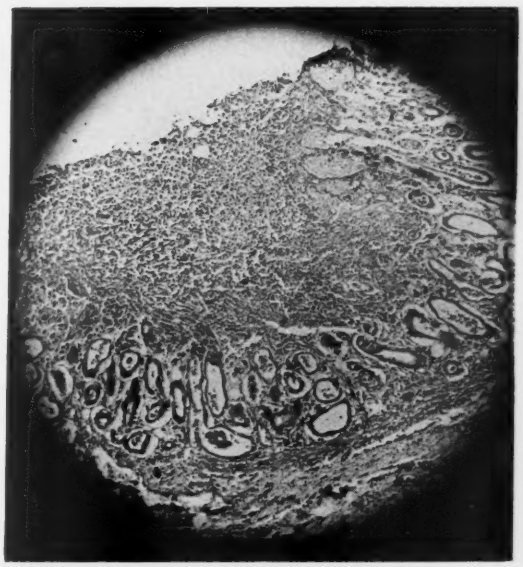

Fig. 3. Circumscribed degeneration of part of the mucosa.

* Cultures of this fluid remained free of colonies after fourty-eight hours' incubation.

to consist of recent adhesions. Both areas were dark grey in color and mushy to the touch. Gas exuded from them and dissected its way upward into the surrounding serosa and under the adjacent omentum.

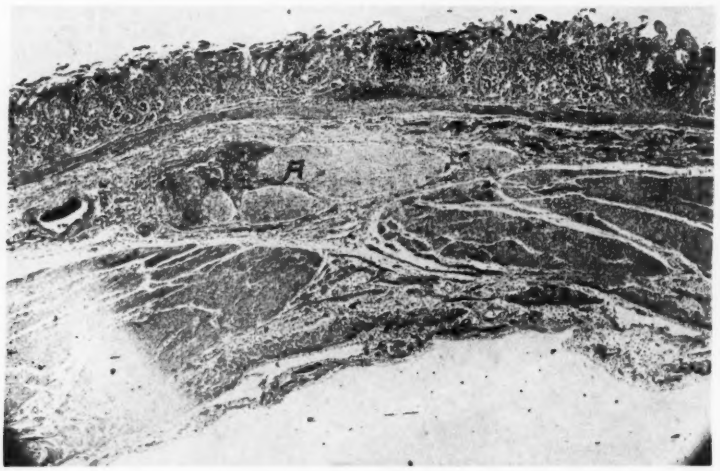

FIG. 4. Suppurative process involving principally the submucosa (A).

In addition to these large areas of necrosis, there were four to five smaller areas of the gastric wall varying in color from red to dark purple which were not as severely involved. The liver and gallbladder appeared normal. Despite a 500 cc. blood transfusion which was being administered during the operation, the patient was doing very poorly. In view of this, no major procedures could be undertaken, and the operation of choice appeared to be a simple infolding of the necrosed areas. Accordingly, the peritoneal cavity was aspirated dry and the involved areas were invaginated by a double row of Lembert sutures. Because of the absence of induration along the involved areas, this could be accomplished without much tension. The great omentum was then tacked over the suture lines as accurately as possible. Two cigarette drains were placed, one in the lesser sac, and another in the left lumbar gutter, and the operation terminated, after the customary layer-by-layer closure of the abdominal wall.

The patient was returned to the ward in partial shock. For the following three days, the temperature varied between 101 and 101.8°F., pulse 132 to 140, and respirations 24 to 28. On August 10, 1940, the third postoperative day, it was noted that the abdomen was soft and not distended, the suture line intact, and that the abdominal wound appeared normal. On August 11, 1940, after twenty-four hours of what appeared to be continuous improvement (the temperature had fallen to 99°F. and the pulse rate to 108), the patient developed difficulty in breathing, and signs of consolidation in the lower left lobe. The blood count at this time showed: red blood cells 5,350,000; white blood cells 8,350; urine p.H 7.5.1010, with traces of sugar and acetone, and hyaline and granular casts. Respirations became labored, cyanosis ensued, and he expired at 11:30 P.M. of the same day, apparently of respiratory failure.

For the sake of brevity, the macro- and microscopical findings only of the stomach will be given in detail. However, for the purpose of completeness, it should be stated that the remainder of the gastrointestinal tract showed no pathological condition. The brain weighed 1,460 Gm. The surface showed no marked abnormalities. Sections were taken through the medulla, pons, midbrain, cerebellum and cortex and stained by hematoxylin and eosin, Nissl and myelin stains. None of these sections showed any definite inflammatory or degenerative changes. As a matter of fact, the only other pathologic lesions found were: atrophy and degeneration of the voluntary muscles, generalized peritonitis, toxic hepatitis, atelectasis of the left lung and bilateral pleural effusion.

The esophagus was opened and showed no gross lesions. Along the greater curvature on the anterior surface of the antrum were suture lines. When these were opened, the greater part of the antero-lateral part of the fundus was found to be necrotic. (Fig. 1.)

A large portion of the fundal mucosa was the site of a diffuse hemorrhagic infiltration. There were also numerous smaller areas 1 to 3 cm. in diameter showing small hemorrhagic infiltration which were sharply set off from the mucosa. Some of these showed early necrosis with softening and ulcer formation. The pyloric end of the stomach and duodenum showed no gross abnormalities.

The stomach showed changes varying from early inflammation to complete gangrene of the entire width of the stomach wall.

Proceeding from the pyloric end of the stomach to the fundus, where the involvement was greatest, the following changes were noted in the layers of the stomach wall:

At the periphery of the involved area, the mucosa appeared generally normal. In areas, however, large masses of lymphocytic tissue were found. In one such area, a large collection of round cells was found and was seen to extend from the submucosa through the entire width of mucosa to its internal surface. This focus which was composed mostly of lymphocytes, contained also mononuclears and plasma cells. Thick strands of connective tissue were seen within this cell mass. (Fig. 2.) As one proceeded to the center of the lesion, one noted first congested vessels, later cellular increase and tissue degeneration. In one such area, the region of degeneration assumed a circumscribed appearance, involved only the upper layers of the mucosa and took an eosinophilic stain. This sharply outlined region suggested necrosis associated possibly with peptic digestion. (Fig. 3.) No limiting zone of inflammatory cells was found, the process apparently having been recent and acute. In the regions of gross necrosis, the mucosa was found to be in a state of marked degeneration so that only the shadowy remains of original tissue were outlined. In such regions there was seen complete exfoliation of the mucosa apparently due to recent necrosis.

The involvement of the submucosa was an outstanding feature of the pathological state in this organ; in fact, the purulent process appeared to spread in the loose tissues of this layer. (Fig. 4.) In the less affected regions, the only abnormalities seen were increase of connective tissue and hypertrophy of the walls of the small arteries. Further one encountered marked congestion, hemorrhage and focal collections of inflammatory cells. The amount of inflammatory exudate, at first noted as a beginning abscess, was seen to spread in all directions but involved especially the submucosa itself. Upon one section there was found a round collection of inflammatory material surrounded by a thin fibromuscular wall, the entire appearance suggesting suppuration in a vessel, probably a vein. The advance of the purulent process finally resulted in an extension through the entire stomach wall with formation of a purulent exudate in the serosa. In the central area of gangrene, all cellular architecture had disappeared.

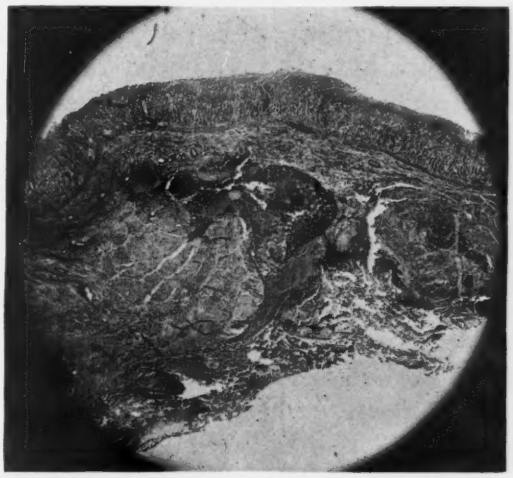

Fig. 5. Purulent process in submucosa and muscularis; perforation through stomach wall; exudate on serosa.

The muscularis was involved by the adjacent suppurative process but to a somewhat lesser degree. In the areas of perforation of course, the muscle fibers were completely degenerated. There was no evidence of any marked antecedent pathological condition in the muscle fibers.

The degree of involvement of the serosa varied with its proximity to the central gangrenous area. At the periphery of the lesion only a comparatively few cells, particularly lymphocytes, were seen. Near the central area of involvement a frank purulent exudate was found. (Fig. 5.)

COMMENT

The violent necrobiotic process in this case bears a resemblance to infarction. However, a careful search of all the vessels in the vicinity failed to disclose thrombosis or occlusion of any vessel.

Of interest in this case is the finding of numerous cell aggregates consisting principally of lymphocytes. In some areas these resemble the lymphoid follicles seen in the gastrointestinal tract generally, except that they do not have the regularity of outline nor do they have a lighter staining germinal center. Some of these collections are particularly large, their cells spread in all directions, and they contain areas of fibrosis. Some others of these areas resemble those of lymphocitic hyperplasia seen in chronic infections. This in itself is interesting.

M. Letulle[3] reported the presence of lymphoid nodules in the walls of the stomach. He was of the opinion that this finding might offer an explanation for the occurrence of such conditions as perigastric tuberculous abscess, perforation of gastric cancers, interstitial abscess and *circumscribed phlegmonous gastritis.*

B. Cuneo[4] in a masterly survey of the entire subject of the lymphatic system of the stomach, describes and portrays two kinds of lymphoid aggregations: encapsulated lymphoid follicles placed immediately above the muscularis mucosae, and diffuse lymphoid elements which surround the secretory glands. In this case, the presence of large masses of round cells *accompanied by fibrosis* would seem to indicate some form of chronic irritation. The pathogenesis of the lesion, however, is not entirely clear. A possible explanation that suggests itself, particularly from the violence of the process* and the absence of any vascular obstruction, is acute peptic digestion. Whether this process was initiated by some form of chronic inflammation in the mucosa or by another factor such as avitaminosis, is unknown; however, once begun, it extended through the loose tissues of the submucosa. The end result was a hemorrhagic and gangrenous process of the gastric wall with massive perforations and peritonitis.

* Indeed, the destruction of parts of the gastric wall was so complete that corrosive poisoning was suggested. However, negative findings upon chemical analyses of portions of the stomach and gastric contents excluded this possibility.

SUMMARY

A case of acute phlegmenous gastritis in a patient with muscular dystrophy is presented.

The pathological processes as found at operation and at autopsy are described and some of the microscopical sections are submitted; from these, however, no decisive clue as to the pathogenesis of the lesions could be adduced.

The evidence on hand indicates* that this case does not belong to the class of similar cases of massive perforation and/or gastromalacia of the stomach and other parts of the upper gastrointestinal tract reported as occurring in association with various lesions of the brain.[5,6] Less certain, however, is the possibility that it may belong to the group of cases of "neurogenic gastric ulcer without primary intracerebral disease" as recently reported by Boles and Riggs.[7]

Finally, the absence of muscle spasm and rigidity in the presence of an acute peritoneal inflammation is pointed out as a curious concomitant of this case.

REFERENCES

1. Troutt, James H. Acute perforation of gastric ulcer. *Surg., Gynec. & Obst.*, 47: 815–821, 1928.
2. Masson et al. Simultaneous perforation of multiple ulcers. *Minnesota Med.*, pp. 289–294, May, 1927.
3. Letulle, M. Ganglions lymphatique parietaux de l'estomac. *Bull. et mém. Soc. d. anat. de Paris*, 74: 1093–1095, 1899.
4. Cuneo, B. De l'envahissement du system lymphatique dans le cancer de l'estomac, etc. These de Paris, 1900.
5. Cushing, Harvey. Peptic ulcer and the interbrain. Fourth Balfour Lecture, April 8, 1931, University of Toronto.
6. Opper, L. and Zimmerman, H. M. Ulcers of the digestive tract in association with cerebral lesions. *Yale J. Biol. & Med.*, 11: 49–84, 1938.
7. Boles and Riggs. Gastric ulcer. *J. A. M. A.*, 115: 1771, 1940.

* Sections of the brain submitted to study failed to yield any evidence of a pathological disorder. We are indebted to Dr. Stevenson of New York University, College of Medicine, for a review of these slides.

PREVESICAL HERNIA

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A SUPRAVESICAL hernia located in the prevesical space of Retzius is a rare condition. Walker, in 1933, presented two cases and found only three others in the literature. His were the only reports in the American literature until Stalker and Gray, in 1939, added another, the only one encountered between 1910 to 1939 at the Mayo Clinic. Wervi and Orr, in 1940, added a fourth and contributed the information, after an exhaustive search of the literature, that in all there were thirty-eight authentic case reports and twenty-three doubtful ones. Their tabulation revealed twenty-three from the German clinics beginning with Linhart's report of one in 1856. That this condition was known prior to that time is proved by a plate appearing in Sir Astley Cooper's book published in 1804 in which six hernial openings, of which two are in the supravesical space, are demonstrated.

ANATOMY

The supravesical area is a triangular fossa limited laterally and above by the lateral umbilical ligaments (the obliterated hypogastric arteries) and below by the peritoneum as it passes from the anterior abdominal wall to the fundus of the bladder. This fossa is divided into two parts by the median umbilical ligament. Beneath the peritoneal reflection and lying between the pubic bone and the anterior wall of the bladder is the prevesical space.

NOMENCLATURE

The multiplicity of names applied to hernias in this region has added nothing but chaos and confusion to the subject. Wervi and Orr list twenty-two different titles applied to these hernias in the supravesical region. The simplest classification since they all arise in the supravesical area is to call them supravesical hernia and to add to this title other terms according to the direction the protrusion takes. These hernias generally take one of three courses: anteriorly, to appear on the exterior in the hypogastrium. These hernias offer no particular diagnostic problem. They may pass through an orifice in the superolateral zone between the lateral border of the rectus muscle and the lower lateral umbilical ligament to appear in the femoral region. Finally, the herniation may extend inferiorly into the prevesical space between the bladder and the pubic bone. This type is most rare and since it is hidden behind the anterior bony pelvis and does not come to the surface is most difficult to diagnose. An example of this form of supravesical hernia was recently encountered and because of its rarety deserves recording:

CASE REPORT

F. M., a male carpenter, forty-two years of age, was admitted to the Cumberland Hospital* on January 14, 1941. His chief complaint began eleven days previously with sudden, sharp epigastric pain that radiated downward to the suprapubic region and to the right lower quadrant. The pain continued the following day and was accompanied by a watery diarrhea. This attack wore off and he was symptomless for four days. At this time he had another severe attack of pain that doubled him up but only lasted for a few hours. He was again free of any symptoms until 9 P.M. of the night of admission at which time his pain came on suddenly in the periumbilical region. Nausea but no vomiting was present. He stated that when he attempted to straighten up the pain was in the umbilical area but when he bent over the pain seemed to be in the suprapubic region. There were no urinary symptoms.

He appeared acutely ill but his temperature, pulse and respirations were normal. He kept

* Surgical service of Dr. John J. Gainey.

his legs flexed believing that he had less pain when in that position. No distention was present nor were any masses felt. Marked tenderness was present in the lower quadrant particularly over McBurney's point. Right lower rectus rigidity and spasm were easily elicited. Rectal examination revealed only a firm, hard prostate gland. Catheterization caused severe pain. His urinalysis was normal. The white cells totalled 16,800 with 86 per cent polymorphonuclear cells. The preoperative diagnosis was acute appendicitis.

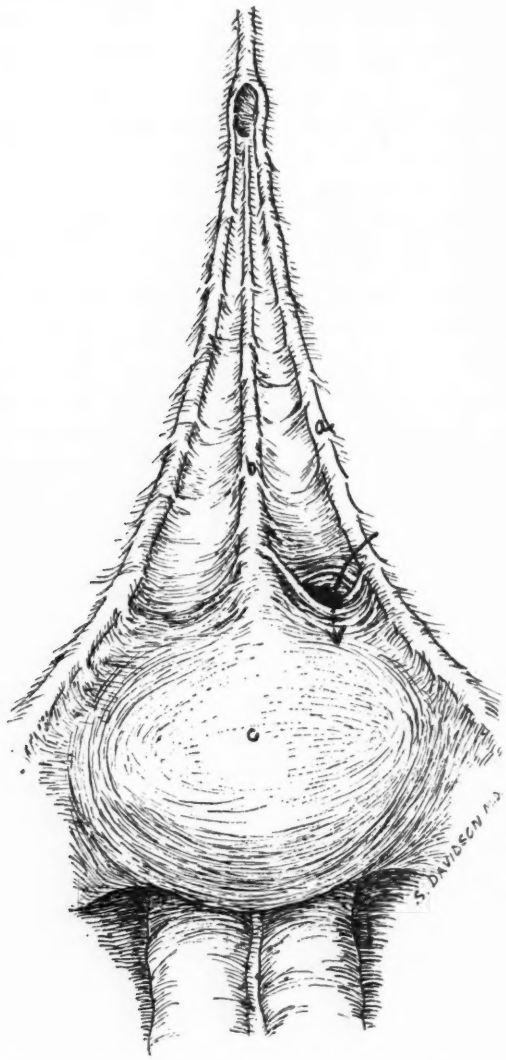

FIG. 1. Supravesical hernia leading to the prevesical space: (*a*) lateral umbilical ligament; (*b*) median umbilical ligament; (*c*) bladder.

Operation was performed four hours after admission under a general anesthesia through a lower right rectus muscle retracting incision. The appendix was found to be retrocecal and about 6 cm. in length. This did not seem to be sufficiently involved to present so severe a clinical picture. The incision was enlarged downward and the pelvis explored. An opening was noted in the anterior peritoneum just above the bladder and between the median and lateral umbilical ligaments. About 10 cm. of small intestine were incarcerated by the rim of this opening and lay in a sac measuring 6.5 cm. in length and extending down in the prevesical space. The incarcerated bowel was delivered and found to be dark red and hemorrhagic but viable. No resection was necessary. The sac was not removed but the opening was closed by a continuous chromic catgut suture. The patient made an uneventful recovery and was discharged from the hospital in eleven days.

COMMENT

The diagnosis is a difficult one to make. Some authors do not believe that the correct diagnosis can be made preoperatively. Wervi and Orr credit Fromme with making such a diagnosis before operation and he used a cystoscope to demonstrate a bulge in the anterior wall of the bladder.

The usual experience has been that these hernias were found accidentally in the course of a laparotomy for some other condition, as in the case here reported, or at necropsy. The clinical picture is ordinarily that of small intestinal obstruction with nausea, vomiting, distention and colicky pains. When these symptoms are accompanied by urinary frequency the possibility of such an internal hernia should be entertained. One may, however, be fooled in the case of elderly male patients with prostatic trouble. The use of the cystoscope to visualize a bulge in the anterior bladder wall is corroborative but may be a dangerous procedure in a sick patient. A scout film is of diagnostic aid and not as taxing to the patient.

The treatment is that for acute intestinal obstruction with repair of the hernial opening. Resection of bowel when necessary will increase the mortality and morbidity. Although some surgeons advocated mobilization and excision of the sac, obliteration of the opening by interrupted or continuous

suture is sufficient for a cure. No recurrences due to failure to remove the sac have been reported.

SUMMARY

1. Hernia into the prevesical space is a rare form of hernia.

2. Diagnosis before operation has rarely been made. But signs of intestinal obstruction and urinary frequency should be suggestive.

3. Cystoscopic examination is corroborative but must be used with care.

4. A scout film is of diagnostic help.

5. Resection of intestine if necessary will increase the morbidity and mortality.

6. Simple closure of the opening will provide a cure. Removal of the sac merely increases the risk.

REFERENCES

Finsterer, H. Hernia supravesicalis interna incarcerata. *Med. Klin.*, 33: 295–297, 1937.

Kochaj, J. and Wolf, J. Supravesical preperitoneal hernia; 2 cases. *Polska gaz. lek.*, 13: 356–357, 1939.

Kramerenko, Y. Y. Hernia supravesicalis interna. *Novy khir. arkhiv.*, 30: 531–547, 1934.

Ovnatanyan, K. T. Hernia supravesicalis interna incarcerata. *Novy khir. arkhiv.*, 34: 409–412, 1935.

Pick, J. Anatomy of paravesical and supravesical hernias. *Arch. f. klin. Chir.*, 190: 553–568, 1937.

St. John, V. Properitoneal hernia. *West. J. Surg.*, 41: 183–190, 1933.

Stalker, L. K. and Gray, H. K. Prevesical hernia. *Proc. Staff Meet., Mayo Clin.*, 14: 321–324, 1939.

Szabo, D. Supravesical hernia. *Orvosi hetil.*, 82: 224–225, 1938.

Wakely, C. P. G. Prevesical hernia; case. *Med. Press*, 203: 37–38, 1940.

Walker, I. S. Hernia into the prevesical space. *Ann. Surg.*, 97: 706–712, 1933.

Wervi, W. N. and Orr, T. G. Supravesical hernias. *Surgery*, 8: 312–325, 1940.

INTRAMUSCULAR INFILTRATION WITH METYCAINE FOR THE RELIEF OF SEVERE AND PERSISTENT POSTOPERATIVE BACKACHE

CASE REPORT

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BACKACHE has been a troublesome experience to most individuals who have been confined to bed for any prolonged period of time. In many instances, the backache may have been so slight as to merely create a mild and transient type of annoyance, but in some cases the pain has been so distressing that opiates were required for relief.

Usually regarded as a minor and rather unimportant postoperative complication, backache has received scant attention in surgical textbooks and publications. For example, Warbasse and Smyth[1] state that, "Pain in the sacrolumbar region commonly complained of after operations can be relieved by placing a pillow in the hollow of the back." Cutting,[2] in his monograph devoted to preoperative and postoperative treatment, advocates as follows: "A small pillow placed under the head, under the normal lumbar curve and under the knees of a patient at the time of operation will do much to prevent the development of the condition. Nurses and assistants should be impressed with the necessity of respecting the body of the unconscious patient to the extent of refraining from using it as a means of support, either for themselves or for other objects, such as basins, pans and trays." The application of the electric pad to the back after operation is urged by Christopher.[3] Meyerding and Pollock[4] describe the condition and advise, concerning the treatment, as follows: "The backache which occurs as the result of overstretching of muscles and the relaxation of ligaments in the course of long anesthesia and which renders the immediate postoperative course a miserable experience, responds within a few days to applications of heat followed by sedative massage. A firmly applied binder, adhesive strapping or a lumbar sling are of great assistance in relieving the discomfort of which these patients complain." Da Costa,[5] however, has the following to say in regard to postoperative backache: "This is a very common and often a very distressing consequence of anesthesia. It is complained of soon after consciousness is regained, it may persist for several days, and is a not uncommon cause of wakefulness. It is usually greatly aggravated by turning, twisting, and by attempting to rise up from the bed. The pain is located in the lumbar and sacral regions and is often accompanied by rigidity of the lumbar muscles. Various explanations have been given for it. One view is that it is due to venal congestion. Another is that it results from congestion of the spinal cord. I believe that the explanation is that given by John Dunlop (New York Medical Journal—July 10, 1909), viz: 'The patients during the operation lay upon a flat table without support to the lumbar curve—consequently the sacroiliac synchrondroses were strained.'" The backache may be largely prevented by placing a small pillow so that it will support the lumbar curve during anesthesia. No mention, however, of postoperative backache is made in textbooks of surgery by Homans,[6] Christopher,[7] and Bickham.[8] Labat[9] and Dogliotti,[10] likewise, make no reference to the condition of postoperative backache in their contributions on anesthesia.

The following case is presented because the relief from postoperative backache afforded the patient by the local intra-

muscular infiltration with metycaine was prompt, complete and sustained:

CASE REPORT

F. L. S., a white male, eighty years of age, was first seen May 6, 1940, with the complaints of dysuria and frequency of urination of ten days' duration which had been becoming progressively worse. Rectal examination at that time revealed a moderately enlarged, tender prostate gland with the greatest swelling and tenderness localized in the left lateral lobe. Severe dysuria and extreme urgency developed the next morning and later during the afternoon an acute urinary retention occurred, with the bladder distended to the level of the umbilicus at 5:30 P.M. An attempt to introduce an indwelling catheter failed because of an obstruction encountered in the posterior urethra, where a peculiar "crackling egg shell" type of crepitus was experienced.

The patient was then referred to a urologist at Iowa Methodist Hospital, Des Moines, Iowa, who was finally able to insert an indwelling catheter after considerable instrumentation. A slow decompression of the bladder was then done. On May 13, 1940, cystoscopic examination revealed a large jagged "clinker" type of calculus imbedded in the posterior urethra. The calculus was removed in piecemeal fashion, and in order to give a badly traumatized posterior urethra a chance to heal, a suprapubic cystostomy was done. The patient then underwent a rather stormy convalescence marked by frequent bouts of abdominal distention and hiccups. About one week following the operation his postoperative course was further complicated, when he began to complain bitterly of a severe persistent type of backache. The backache was always much worse at night, and of such intensity that it was impossible for him to obtain sufficient rest and sleep. The pain was partially controlled for the first four days by the hypodermic administration of codeine, but later morphine had to be given in increasing dosage to afford him adequate relief. Toward the end of his hospital stay, the morphine was gradually reduced, and then withheld completely as it was suspected that addiction to morphine had developed. Hypodermic injections of sterile water were then substituted for the morphine, and seconal and phenobarbital were given orally, but the patient complained constantly at night and occasionally during the daytime of severe back pain.

The patient was released from the hospital on June 12, 1940, at his own request and was returned to his hime. This decision was contrary to the advice of the consulting urologist. Backache, which then continued, was not very troublesome during the day. However, at night the pain became so severe that the patient was given ¼ gr. of morphine sulfate by hypodermic at bed time. Alcohol rubs, massage, hot water bottle applications and changes in position afforded him but slight and temporary relief. The patient's back muscles were examined every night and on each inspection, tender masses of spastic musculature extending bilaterally from the eighth thoracic vertebra to the fourth lumbar vertebra were palpated. The errector spinae, trapezii, and serrati posterior inferior muscles were affected to an equal degree on both sides.

On June 21, 1940, the backache became much worse and inspection of the back revealed rigid, exquisitely painful masses of muscle in the usual locations. Several hypodermic injections of morphine sulfate (¼ gr.) and dilaudid hydrochloride (1/20 gr.) gave the patient relief from pain for periods varying from four to eight hours. At 4 P.M. on June 23, 1940, 12 cc. of 2 per cent metycaine solution were injected through six intracutaneous metycaine wheals, directly into the rigid muscular masses. As a precautionary measure, however, one capsule containing 1½ gr. of seconal was given the patient fifteen minutes before the injection in order to neutralize any possible toxic effects due to metycaine. Partial relief from pain occurred in three minutes after the injection and complete relief experienced two minutes later lasted for a period of sixty-four and one-half hours. Recurrence of backache was then first noticed by the patient at 10:30 A.M. on June 26, 1940, and at 6:20 P.M. after the pain had become intense, 15 cc. of 2 per cent metycaine solution were injected through eight intracutaneous metycaine wheals, again directly into the mass of spastic musculature. One seconal capsule representing 1½ gr. of that drug was taken by the patient fifteen minutes prior to the injection. Complete relief from pain on this occasion was obtained in six minutes following the metycaine injection. The patient then enjoyed complete relief from pain for ninety-four hours

and forty minutes until 4 P.M. on June 30, 1940, when he complained of mild backache which was easily controlled by backrest, alcohol rubs and massage.

On July 1, 1940, he was moved to his daughter's home in the country for further convalescence. No recurrences of backache occurred during the next two months, after which he became ambulatory.

SUMMARY

1. An unusual case of severe and persistent postoperative backache in a white male eighty years of age is described.

2. Two per cent solution of metycaine was administered by local intramuscular infiltration on two occasions.

3. The patient was afforded complete and sustained relief from backache for periods of sixty-four and one-half and ninety-three and two-thirds hours, respectively.

REFERENCES

1. Warbasse, J. P. and Smyth, Jr., C. M. Surgical Treatment. Vol. 1, p. 204. Philadelphia, 1937. W. B. Saunders Company.
2. Cutting, R. A. Principles of Preoperative and Postoperative Treatment. P. 110–111. New York, 1932. Paul B. Hoeber, Inc.
3. Christopher, F. Minor Surgery. P. 917. Philadelphia, 1934. W. B. Saunders Company.
4. Meyerding, H. W. and Pollock, G. A. Backache: common causes and treatment with special reference to physical therapy. *Arch. Phys. Therap.*, 21: 69–77, 1940.
5. DaCosta, J. C. Modern Surgery—General and Operative. P. 1135, 10th ed. rev. Philadelphia, 1931. W. B. Saunders Company.
6. Homans, J. A Textbook of Surgery. Springfield, 1931. Charles C. Thomas.
7. Christopher, F. Textbook of Surgery. Philadelphia, 1936. W. B. Saunders Company.
8. Bickham, W. S. Operative Surgery. Vols. I–III. Philadelphia, 1924. W. B. Saunders Company.
9. Labat, G. Regional Anesthesia—Its Technic and Clinical Application. 2d ed. Philadelphia, 1930. W. B. Saunders Company.
10. Dogliotti, A. M. Anesthesia, Narcoses, Local, Regional and Spinal. Translated by Carlo S. Scuderi. Chicago, 1939. S. B. Debour.

ABDOMINAL NEUROFIBROMATOSIS*

CASE REPORT

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WITH the ever increasing interest in new growths, which is rightfully merited, it is necessary to be on the alert for any condition that might come under this category, since the diagnosis very often determines the therapy and prognosis. When abdominally located, there are ever so many possibilities, one of the more infrequent ones being Von Recklinghausen's disease. In view of its relative rarity and yet its possibility in every case of neurofibromatosis, it was deemed worthy to re-emphasize this condition with the following case report:

CASE REPORT

C. C., a ten year old colored boy was admitted February 20, 1940, with a history of having epigastric pain which had begun one day before admission, following a heavy meal. He was given a cathartic and the pain subsided, but he had had no bowel movement for twenty-four hours. In addition, he gave a history of having a nodule on his head, which he said followed a fall out of a baby carriage during infancy, but it had not been present before.

His past history revealed that he was a normal delivery with normal postanatal development. He had had occasional sore throats and colds, scarlet fever at eight years and varicella at ten, while in 1938 he had a fracture of his leg with perfect recovery. The family history was essentially negative, the father having died of an unknown cause; but, so far as we could ascertain, there was no evidence in the family history of a similar lesion.

The physical examination revealed the following salient features: There was a ptosis of the left superior palpebrum with impaired vision in that eye. The cervical nodes bilaterally were enlarged, shotty and indurated. A subcutaneous tumor mass about the size of an egg was noted over the right side of the head, and subcutaneous nodules were found in the middorsal region, all of which were freely moveable. In addition, there were small, hard, freely moveable nodules over both upper extremities, especially on the extensor surfaces. There was also a hard mass palpable in the right lower quadrant of the abdomen and in the scrotum.

His blood Wassermann, blood chemistry, heterophile reaction, several urine examinations and throat culture were all negative. His mantoux test was positive. A blood count on February 20 revealed a hemoglobin of 68 per cent red blood count 2,850,000, white blood count 9,200, polymorphonuclears 52 per cent of which 4 were immature, lymphocytes 45 per cent and eosinophiles 3 per cent.

On February 29, a pyelogram showed that the ureters were displaced laterally below the fourth lumbar body, while the bladder showed extrinsic pressure which displaced it to the left and upward, giving the impression of an intra-abdominal mass probably retroperitoneal. A biopsy from a node on the right forearm revealed evidence of neurofibroma.

On March 7, a barium enema revealed no intrinsic pathological condition in the large bowel but showed extrinsic pressure on the rectal ampulla and distal sigmoid displacing this portion of the bowel to the right. *X*-rays of all the bones of the body were negative while another blood count on March 15 showed a hemoglobin of 70 per cent, red blood count

* From the Pediatric and Surgical Services of the Metropolitan Hospital, New York City.

3,120,000, white blood count 8,760, polymorphonuclears 61 per cent, lymphocytes 36 per cent, eosinophiles 2 per cent and mononuclears 1 per cent.

Fig. 1. Encircled area is that of a neurofibroma on the right side of the head.

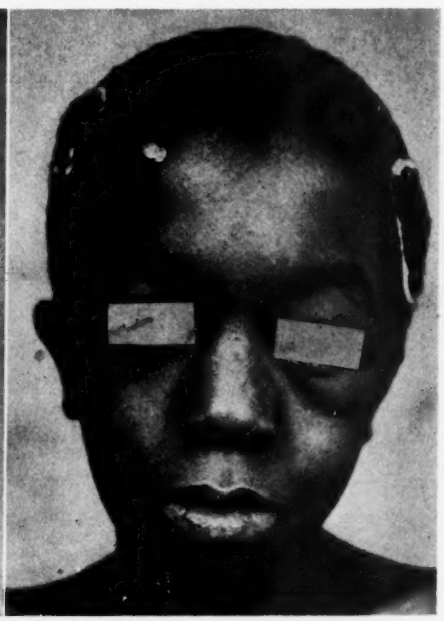

Fig. 2. Edema and slight ptosis of the lids of left eye. Encircled areas indicate site of neurofibromas.

The abdominal mass continued to enlarge and in addition on March 25 edema of the left upper eyelid was noted, the left lower lid appeared to droop and on April 4 a slight swelling was noted in the infra-orbital region. A blood count at this time revealed a hemoglobin of 76 per cent, red blood count 3,600,000, white blood count 9,100, polymorphonucleus 60 per cent, lymphcytes 34 per cent, eosinophiles 3 per cent and mononuclears 3 per cent, which was a definite improvement over the previous results.

On April 9, a large nodular mass was noted involving the spermatic cord and epididymis while the original mass had extended to the umbilicus, was fixed to the abdominal wall and was irregular in contour. Rectal examination revealed a nodular mass infiltrating the anterior rectal wall.

On April 16, 1940, an exploratory laporotomy was performed. A right rectus incision was made and immediately upon opening the peritoneum, large masses were noted practically filling the abdominal cavity. The mass extended on the right side, well over the liver; and as it was traced downward, it was seen to extend across in front of the vertebral column and to infiltrate widely the mesentery. It extended well down, involving the sigmoid colon, the bladder wall, and was felt to extend well down on either side into the scrotum. It involved the peritoneum and the lateral wall of the abdomen as well. The gross appearance of this mass was of a greyish, glass-like substance resembling fish meat. A large portion of the mass was removed for biopsy which, on section, preserved the glassy appearance.

Microscopically, there was noted proliferation of fibroblastic cells intermingled with fibrillar tissue and the diagnosis of Von Recklinghausen' disease was made.

The temperature, pulse, and respiration were normal throughout except on two occasions lasting two days each when the temperature rose to 102°F. because of acute pharyngitis and tonsillitis. The wound healed by primary intention and the patient was discharged on May 9, 1940.

DISCUSSION

Of the peripheral nerve tumors, there are two types,[1,2] the true neuroma which arises from or is composed of nerve fibers or cells; and the false type which arises from the nerve sheaths[3,4,5] of spinal or cranial nerves.

The latter [1,2] is the more common and within its classification is found Von Recklinghausen's disease, which is charac-

terized[1,2,3,5,6,7,8] by various sized, single or multiple, usually symmetrically located, nontender pigmented tumors; cutaneous dysplasia in the form of yellow or brown pigmentations with the general skin often being darker than that of other members in the family; and an associated disturbance in growth[9,10] and mentality[3,5,7,11,12,13] in some cases.

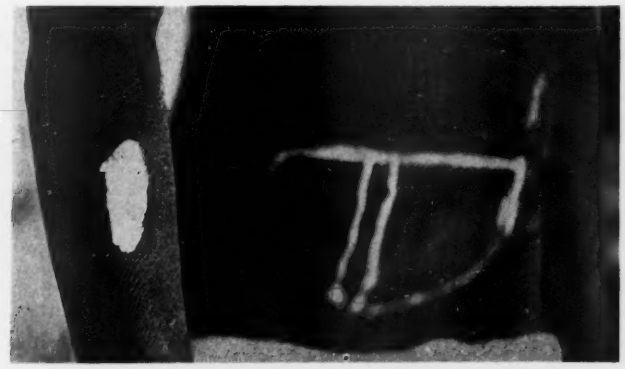

Fig. 3. Demarcated region on abdominal wall demonstrating the size of the palpable abdominal mass. The vertical lines show the site of the incision. A neurofibroma of the right forearm is also noted.

The tumors are mostly congenital[3,12] and appear at birth or very soon thereafter and may either remain unchanged until activated[5,7,8,14,15] at puberty or later, or during pregnancy or menopause, or may increase in size and number early and rapidly. Removal[12,14,15,16] is often followed by recurrences; and cystic, myxoid or malignant degeneration,[3,13] the latter especially in ganglioneurofibromas,[17] has been observed in 12 to 14 per cent of the cases.[8]

Their distribution[5,6,8,12,18] is by no means confined to the skin and subcutaneous tissue but may be wide and variable, having been encountered in the abdominal,[6,12,13,14,15,18,19,20] cranial,[6,21] spinal,[4,22] and thoracic cavities,[8,15,20,23,24] as well as the bony structures[6,7,10,25] and in association with the organs within and about these areas. Pressure symptoms may arise and in the abdominal type[12,26] may result in all clinical varieties of obstruction, hemorrhage,[14] and perforation. At times, melanotic placques[2] in the epidermis may cause paralysis of isolated nerves.

Histologically,[13,21,27,28,29] there is present proliferation of the perineurium, endoneurium and the ectodermal connective tissue (Schwann's sheath) so that the tumor appears to be composed mostly of small sized, mature cells from connective tissue which surround nerve fibers that are often swollen and irregular, and this gives a typical palisade formation and whorling fibrous structure which is characteristic of neurofibroma.

Etiologically, heredity[1,2,3,4,5,7,30,31] has been demonstrated in 18 to 74 per cent of the cases.[8,32]

Among the conceptions[4] offered as to its origin have been: (1) That they are malformations and groups of aberrant cells; (2) that an endocrine disturbance[9,33,34,35] is the basis since many cases[5] have been associated with growth changes; (3) that it is due to an anomaly[3] of development of the nervous system in early fetal life.

The condition[3,8] is not sex linked and tends to recur in successive generations of involved families and, therefore, some[5,7,8,31,36] believe it is inherited as a Mendelian dominant character.

Regarding its treatment when located within any of the body cavities or organs, surgery and deep irradiation[16] have been the methods employed, with some reporting good results,[4,5,8,12,14,16,18,19,20,24] others mortalities,[6,13,21] while some[16] have noted recurrences following removal of the tu-

mors. However, in these cases some active form of therapy is necessary for the relief of symptoms and surgery is the method of choice with follow-up by irradiation.

SUMMARY AND CONCLUSIONS

1. A case of massive abdominal neurofibromatosis in a colored child is reported.

2. In view of its hereditary nature, there should be a constant lookout for the condition in all blood relations of any affected family.

3. In every dermal case, the threat of visceral involvement is a constant potentiality.

4. Therefore, if any visceral symptoms coincide with cutaneous manifestations, the assumption should be that there is an analogous tumor involvement of the viscera until proved otherwise.

REFERENCES

1. Pollack, L. J. Cecil's Textbook of Medicine. 4th ed., p. 1439. Philadelphia, 1936. W. B. Saunders Co.
2. Woltman, H. W. Tice's Practice of Medicine. Vol. 9, p. 361. Hagerstown, Md., 1925. W. F. Prior Co.
3. Ford, F. Brennermann's Practice of Pediatrics. Vol. 4. Hagerstown, Md., 1937. W. F. Prior Co.
4. Alessi, D. *Policlinico*, 46: 2043, 1939.
5. Levin, D. L. and Behrman, H. T. *Arch. Dermat. & Syph.*, 41: 480, 1940.
6. Golm, G. and Christeller, E. *Med. Klin.*, 22: 1188, 1926.
7. Preiser, S. and Davenport, C. *Am. J. M. Sc.*, 156: 507, 1918.
8. Jones, R., Jr., and Hart, D. *Ann. Surg.*, 110: 916, 1939.
9. Gordon, M. B. *Endocrinology*, 13: 553, 1929.
10. Lehman, E. and Brooks, B. *Surg., Gynec. & Obst.*, 38: 587, 1924.
11. Charpentier, J. *Encéphale*, 5: 460, 1910.
12. Juaristi, V. *Rev. de cir. de Barcelona*, 11: 133, 1936.
13. Jentzer, A. and Fatzer, H. *Schweiz. med. Wchnschr.*, 67: 569, 1937.
14. Barton, A. D. and Keith, I. *J. Coll. Surg. Australasia*, 3: 397–402, 1931.
15. Serre, R. Contribution to the Study of the Visceral Localizations of Recklinghausen's Disease. Thesis, Paris, 1923.
16. Adson, A. W., Moersch, F. P. and Kernohan, J. W. *Arch. Neurol. & Psychiat.*, 41: 535, 1939.
17. Lewis, D. and Geschickter, C. F. *Arch. Surg.*, 28: 16, 1934.
18. Hoey, T. *Brit. M. J.*, 2: 490, 1928.
19. Wolff, P. *Schweiz. med. Wchnschr.*, 66: 379, 1936.
20. Wright, F. H. and Paige, B. H. *J. Pediat.*, 14: 137, 1939.
21. Scott, P. *Proc. Roy. Soc. Med.*, 31: 1417, 1938.
22. Gordon, A. *Arch. Dermat. & Syph.*, 37: 983–986, 1938.
23. Dyggvl, L. P. *Finska läk.-sällsk. handl.*, 79: 133, 1936.
24. Makkas, M. *Bruns' Beitr. z. klin. Chir.*, 159: 276, 1934.
25. Stahnke, E. *Deutsche Ztschr. f. Chir.*, 168: 6–18, 1922.
26. Smith, F. R. *Am. J. Cancer*, 15: 859–862, 1931.
27. Rhoads, C. P. and Van Wagenen, W. P. *Am. J. Path.*, 4: 145–152, 1928.
28. Penfield, W. and Young, A. W. *Arch. Neurol. & Psychiat.*, 23: 320, 1930.
29. Penfield, W. *Arch. Neurol. & Psychiat.*, 27: 1298–1308, 1932.
30. Bucy, P. C. Tice's Practice of Medicine. Vol. 9, p. 569, 1925.
31. Gardner, W. J. and Frazier, C. H. *Arch. Neurol. & Psychiat.*, 23: 266, 1930.
32. Sharpe, J. C. and Young, R. H. *Arch. Int. Med.*, 59: 299–328, 1937.
33. Tucker, B. *Arch. Neurol. & Psychiat.*, 11: 308–320, 1924.
34. Elliott, C. A. and Beifeld, A. F. *J. A. M. A.*, 63: 1358–1362, 1914.
35. Jackson, A. H. *J. Nerv. & Ment. Dis.*, 78: 581–596, 1933.
36. Frets, G. P. *Genetica*, 11: 347–366, 1928–1929.

THE USE OF A STERILE RUBBER GLOVE AS A COVERING FOR THE DURAL DEFECT RESULTING FROM THE REMOVAL OF A SPINAL CORD TUMOR

CASE REPORT

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THE following case is reported to present a method of repairing dural defects which result from either the necessary or the traumatic resection of a part of the dura covering the brain or spinal cord. It has long been a neurosurgical custom to replace resected dura with a sheet of Cargile membrane or animal membrane, with the idea that this preparation will afford some means of protection while the dura is rapidly being regenerated beneath it. The membrane is rarely sutured to the surrounding dural edges but is simply placed over the defect. It is difficult to secure these membranes and, since this is particularly true in the armed services where supplies are of necessity limited, the procedure herein to be described may prove of value to surgeons in combat areas who have occasion to repair dural defects but who do not have available the finer equipment and materials usually employed.

CASE REPORT

A white soldier, twenty-three years old, was admitted to Lovell General Hospital on January 19, 1942. He had felt well until six months prior to his admission to a Station Hospital. He began to notice that his legs were becoming weak and found that he could not jump a hurdle higher than three feet, whereas previously he had shown athletic ability. This weakness persisted but he thought little of it. Two months later, when on maneuvers, he noted that he was unable to perform his duties as well as did the other soldiers. His legs seemed weak and stiff. He was hospitalized at a Station Hospital for approximately one month and was then transferred with a diagnosis of multiple sclerosis to another Station Hospital. Meanwhile the weakness and stiffness of the lower extremities became progressively worse. There were occasional fibrillary twitches in the muscles of the legs, as well as a tingling sensation over the entire lower half of the body and legs. He staggered when he walked and felt as though he were walking on pillows. At no time did he experience pain. He had difficulty in starting his urinary stream and was constipated. All of these symptoms progressed so that at the time of his admission to Lovell General Hospital he was unable to stand or walk, and any slight change in position of his lower extremities produced an extreme, sustained ankle clonus. However, he still had some control over his bladder and bowel functions and he did not complain of pain.

Neurologic examination at this time revealed normal function of the cerebrum and cerebellum and of the cranial nerves. Examination of the upper extremities was negative, but examination of the lower extremities revealed the muscles to be weak, almost completely paralyzed and hypertonic. There was anesthesia extending from the anterior costal margin downward over the trunk and over both legs. There was loss of sensation of pain and temperature, although that of light touch was preserved. Vibratory sense, as well as position sense and deep sensibility, was lost from the iliac crest downward bilaterally. The reflexes were exaggerated. The Babinski and Rossolimo signs were positive. There was a sustained ankle clonus on both sides. Careful roentgenographic studies of this area were negative, but spinal puncture revealed a complete subarachnoid block with an increased spinal fluid protein of 85 mg. per cent. There was a positive Beevor's sign in that the umbilicus moved upward upon flexion of the

body. The abdominal and cremasteric reflexes were absent. The remainder of the study of the patient was negative. A diagnosis was made of meningioma at the level of the fifth dorsal vertebra.

A dorsal laminectomy was performed on January 26, 1942. The operative report follows:

"Under local anesthesia, the usual subperiosteal approach to the lamina of the fifth, sixth and seventh dorsal vertebrae was carried out. The spinous process and the uppermost portion of the lamina of the fifth dorsal vertebra were removed and it could be seen that the cord was pulsating freely at this level. It was assumed that the block must exist caudad so I then began to remove the lower portion of the lamina of the fifth dorsal vertebra and all of the lamina of the sixth dorsal vertebra. Immediately upon reaching the inferior portion of the fifth dorsal vertebra, a firm reddish mass could be seen, which was extradural and compressing the dura to the right. This was followed down, necessitating the removal of all of the laminae of the sixth dorsal vertebra and a few bites of the upper portion of the seventh dorsal vertebra. The tumor was then exposed in its entirety. It consisted of an envelope which covered the entire posterior portion of the dura and extended laterally on the left side to almost the midline anteriorly. This tumor, presumably a meningioma, was 1 cm. thick and approximately 7 cm. long and was of a firm consistency. The area was cleaned up, the epidural fat removed, and I began the attempt to remove the tumor. This was accomplished by wiping away the discrete mass from the lower and superior portions with cotton patties, using silken threads as retractors. It was then found that the posterior, lateral and anterior portions of the tumor combined and extended through the intervertebral foramen, encompassing the nerve root at this level and forming a dumbbell on the outside of the bone. This tumor was removed, separating it from the dura and sacrificing the nerve root. The portion that was outside the bone was curetted out with a pituitary spoon and the few cells that were remaining outside of the bone were coagulated with the Bovie unit. Then because of the fact that the tumor had arisen from the dura at this point, the dura being involved for a distance of 4 cm., I opened the dura. This was done with no undue difficulty and it was found that a tumor, almost as large as that outside the dura, was growing inside and severely compressing the cord at this point. This tumor also was wiped away, necessitating the sacrifice of the posterior root. It was also attached to the dura so that it became necessary for me to sacrifice a length of dura 4 cm. long and 2 cm. wide. The entire procedure had been very vascular, as is usually the case when dealing with a meningioma. Hemostasis was obtained by means of the Bovie unit and muscle stamps. It then became necessary for me to replace the sacrificed dura, which is usually done by using a sheet of animal membrane, not available in this hospital. Accordingly, I used the back of a sterile rubber glove and repaired the dural defect with this thin sheet of rubber. The wound was closed in the usual fashion. The patient's condition at the termination of this operation was good."

The postoperative course was uneventful. Upon his return to the ward, the patient noticed an immediate improvement in the function of his lower extremities. The ankle clonus had disappeared, as had the positive Rossolimo and Babinski signs. His condition improved rapidly and on the eighth day, when the sutures were removed, there was no anesthesia present. There was still some posterior column involvement, a condition to be expected since the greater portion of the tumor lay on the posterior column. The spasticity and increased reflexes had also disappeared. At the end of two weeks he was walking. He was somewhat ataxic but this condition has gradually disappeared. He is walking normally and has only a slight diminution of vibratory sense below the iliac crest. The wound remained clean and healed well, with no indication of any reaction, there being only a fine linear scar resulting from the incision. During the four months following the operation, repeated white blood cell counts and sedimentation rates were studied, as well as roentgenograms of the area involved. The white blood cell counts and the sedimentation rates have all been normal and roentgenograms have shown no sign of an inflammatory process. Spinal puncture, performed a month after the operation, revealed no evidence of a subarachnoid block. There were no cells in the spinal fluid. The microscopic sections of the tumor proved it to be a meningioma.

SUMMARY

1. An operation is described during the course of which a large area of dura had to be sacrificed to facilitate the removal of a large, double dumb-bell type of spinal cord tumor. This dura was replaced with rubber from the back of a sterile rubber glove and the patient had an uneventful convalescence with no evidence of inflammatory reaction.

2. The method of repair of dural defects described was suggested by the original work of Giangrasso,[1] who covered dural defects in animals with rubber from discarded gloves and who found that dural regeneration was rapid and that restoration of dural continuity was achieved without the formation of adhesions.

3. This method may be of particular value in the armed forces where Cargile membrane or other animal membranes are difficult to obtain.

REFERENCE

1. Giangrasso, G. Use of rubber glove to cover dural defects in dogs. *Ann. ital. di chir.*, 19: 431–435, 1940.

Dysphagia may be defined as an embarrassment of swallowing due either to painful, nervous, or anatomical interference with this function. The cause of painful deglutition may be present in the mouth, pharynx, hypopharynx, or esophagus itself.
From "Symptoms in Diagnosis" by Jonathan Campbell Meakins (Little, Brown and Company).

ACUTE HEMATOGENOUS STAPHYLOCOCCIC OSTEOMYELITIS OF FEMUR

SUCCESSFUL TREATMENT WITH SULFATHIAZOLE WITHOUT OPERATION

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IN December 1941, Hoyt, Davis and VanBuren reported the first cases of acute hematogenous osteomyelitis treated with sulfathiazole without operation. The results in their eight cases were so encouraging that we decided to try out this method of therapy.

CASE REPORT

On December 13, 1941, a white boy, age fourteen, was admitted to the surgical service at the Delaware County Hospital with a diagnosis of acute osteomyelitis of the right femur. One week prior to admission he had received a hard bump on the right thigh while playing football, from which he had apparently completely recovered during the next two or three days. Twelve hours before admission the patient developed pain along his entire right thigh, which was continuous and progressive. Six hours later the pain was quite intense and was accompanied by chills, fever and headache. Tonsils and adenoids had been removed one year before. There had been no other operations and no serious illnesses.

Physical examination revealed a well developed boy with signs of toxemia but well orientated and co-operative. No focus of infection was demonstrable. Pathologic findings were limited to the lower one-third of the right thigh where there was marked tenderness and slight swelling, especially on the anterolateral aspect, near the epiphysis. There was no redness, induration or fluctuation. The knee joint did not appear involved, was most comfortable in a semiflexed position, and any attempt to change this position produced marked pain just above it. Temperature was 102²°F., pulse 118, respiration 22, hemoglobin 104 per cent, red blood cells 4,900,000, white blood cells 17,200, polymorphonuclears 71 per cent, stabs 12 per cent, segmented 59 per cent. Urine was normal.

An initial dose of sulfathiazole, Gm. 2.0, was given by mouth followed every four hours by Gm. 1.0. In addition, oral fluids were freely taken and well tolerated. Hot saline dressings were applied locally and the leg immobilized. Three hours after admission temperature rose to 104²°F. and pulse 132 and continued at about this level for forty-eight hours, following which a gradual decline occurred associated with an improvement of symptoms. Sulfathiazole blood level was only 2.0 mg. per 100 cc. at this time. Blood culture on the second day showed staphylococcus in four days. From the sixth to the ninth day the temperature and pulse stabilized at about 100 and 110, respectively, and at this point the dose of sulfathiazole was increased to Gm. 2.0 every four hours. A gradual improvement followed so that by the fourteenth day his temperature and pulse were normal and remained so. A blood transfusion of 250 cc. of whole blood was given on the fourteenth day because of a mild secondary anemia and for a general supportive measure. Because of the disappearance of the signs and symptoms sulfathiazole was discontinued on the eighteenth day. The patient was out of bed on the nineteenth, walking on the twenty-first and discharged on the twenty-fourth day. *X*-ray examinations of the femur three days and thirteen days after onset of symptoms were negative. Since discharge from the hospital there has been no recurrence of symptoms, his physical activities have been unrestricted, and an *x*-ray taken March 12, 1942, three months after onset of symptoms, was negative.

The reasons for reporting this case are (1) It presents a new method of therapy; (2) by reporting individual cases a large series from different surgeons can be gathered together and properly evaluated; (3) this is a typical case clinically; (4) complete recovery was secured without operation or any subsequent indication for

operation; (5) there was a comparatively short period of hospitalization with no deformity resulting; and (6) it is important from a military standpoint.

CONCLUSIONS

1. No attempt should be made to treat this disease in the home.

2. The patient should be hospitalized and treatment instituted twenty-four hours after onset.

3. The earlier sulfathiazole treatment is begun, the better should be the result, in extent of bone destruction, period of hospitalization, disability and mortality.

4. Low blood sulfathiazole level was due to forcing of fluids. When forcing of fluids is necessary, the dosage of sulfathiazole should be increased rather than decrease the fluid intake.

5. Immobilization of affected part decreases pain and avoids irritation of inflammatory area.

6. Several supportive measures should not be neglected, such as fluids and transfusions, caloric intake—vitamins, proteins, minerals, etc.

REFERENCE

Hoyt, Davis, and VanBuren. Acute hematogenous staphylococcic osteomyelitis. *J. A. M. A.*, 117: 2043–2050, 1941.

Massage and passive motion have a distinct use in preserving muscle tone and maintaining blood and lymph circulation. However, both of these measures may be used with care and judgment. A good working rule is that which says passive motion that causes pain is harmful.
From "A Manual of the Treatment of Fractures" by John A. Caldwell (Charles C. Thomas).

SPONTANEOUS RUPTURE OF THE UTERUS IN THE FOURTH MONTH OF GESTATION

CASE REPORT

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THE following is a case report of spontaneous rupture of the uterus in the fourth month of gestation:

Mrs. J. H. was first seen November 27, 1941. Her chief complaint was sterility. She had been married two years and wanted children badly, but had been unable to conceive. The patient was an obese, white female, nineteen years of age. After an examination she was found to be hypothyroid and was put on thyroid medication. During the first three weeks on thyroid medication the patient lost fifteen pounds in weight. Two months after her first visit she missed her first menstrual period. Two months after the onset of her amenorrhea a pelvic examination revealed an enlarged uterus.

After becoming pregnant the patient experienced no particular symptoms except a moderate morning sickness. On the morning of May 12, 1942, I was called to see her and found she was having uterine contractions which I interpreted as a threatened abortion. There was no vaginal bleeding. The patient was given an injection of a barbiturate. I went to my office to get some progesterone and vitamin E and when I returned to the patient within an hour found her in deep shock. She was pallid, pulseless, cold, sweating, and only semiconscious. She was given coramine, hot water bottles were put to the body, and the patient was taken to the Kelly Hospital in Argos, Indiana, where she was seen in consultation with Dr. F. H. Kelly. The patient was moribund when she entered the hospital and expired in about thirty minutes after admission, despite the use of artificial respiration, oxygen and stimulants. Expiration took place about four hours after the onset of symptoms.

The clinical picture was obviously due to intraperitoneal hemorrhage, but it was impossible to operate without controlling the shock. We did not have time to type the patient for a transfusion, and a transfusion would have been very difficult because of the obesity, very tiny veins and their collapse due to shock. It was impossible to determine the source of the hemorrhage because I was sure it was a uterine and not an ectopic pregnancy.

On opening the abdomen at autopsy the peritoneal cavity was found to be filled with liquid, clotted and semiclotted blood. The blood was wiped away, and the placenta was encountered lying about the legs of the fetus. The umbilical cord was twisted around the legs of the fetus. The fetal head still lay within the uterus. The fetal neck was emerging from an opening in the superior aspect of the fundus. The fetus, a female, was 15 cm. long. The uterus was contracted down so that the cavity would just contain the fetal head.

The mother on my first visit denied a fall or any other injury, and the couple wanted a child so badly I am sure no attempt at an abortion had been made. Therefore, I am constrained to believe this was a case of spontaneous rupture of the uterus. The patient had never had a previous abdominal operation.

The only explanation I can think of is that there was a congenital hypoplasia of the myometrium, and as the uterus enlarged a bulging occurred just as an inner tube will bulge through a weak place in a tire. Contractions were initiated, and the fetus was forced through the weak place, rupturing the uterus, and causing death from an intraperitoneal hemorrhage. There was never any vaginal bleeding. No histological study of the uterus was made.

New Instruments

A WIRE SPLINT FOR WRIST

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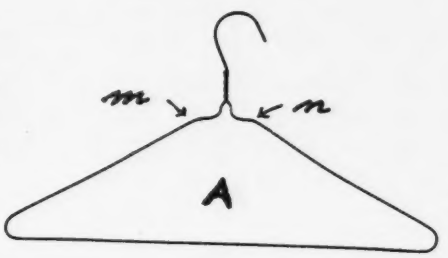
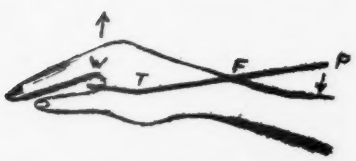
A WRIST splint which is simple, light, inexpensive and easily made in a matter of minutes from readily available material is herein described.

FIG. 1. Lever principle applied to wire splint: P, power; W, weight to be lifted; F, fulcrum. Arrows denote direction of applied and resultant forces. The angle at point T enables us to increase the amount of dorsiflexion to the desired amount.





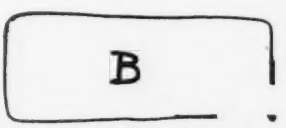


FIG. 2. A, standard type of wire coat-hanger. Cut wire at points *m* and *n*, and discard the hook section. B, Rectangle of wire held together by looping ends in opposite planes and fastening with adhesive. Excess of wire may be cut off and discarded.

Based on the mechanical principle of a first class lever, the splint pushes the wrist into dorsiflexion. (Fig. 1.)

Take an ordinary wire coat-hanger (Fig. 2A), cut away the entire hook part and discard it and straighten out the remaining wire. This will yield a wire rod $\frac{3}{32}$ of an inch in diameter and about 30 inches long. Bend this wire rod into a rectangle. (Fig. 2B.) The width of the rectangle is a trifle larger than the diameter of the clenched fist and its length is the distance from the midpalm to about 2 inches short of the fold of the elbow. The ends of the wire are looped over in opposite planes and held in place with adhesive.

The distal cross-bar is padded with any soft material. The patient then grasps this padded handle-bar and the rectangle rests on the dorsum of the forearm. At the level of the radial styloid the splint is bent upward approximately equivalent to the desired angle of dorsiflexion. (Fig. 3B.) Trial and experience will determine the angle of upward tilt. Cover the proximal two-thirds of the splint with an apron of double adhesive or any similar firm material. (Fig. 3A.) As pressure is applied to the

apron the padded handle-bar forces the wrist into a cock-up position. The fulcrum of leverage is at the free edge of the apron. adhesive, covered by a firm bandage, keeps the splint in position. (Figs. 4 and 5.)

The resiliency of the wire is such that a

Fig. 3.

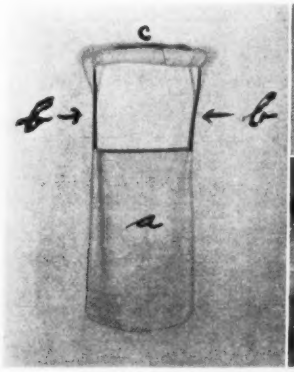


Fig. 3. Completed splint: *a*, adhesive apron; *b*, angulation for increased dorsiflexion; *c*, handle bar.

Fig. 4.

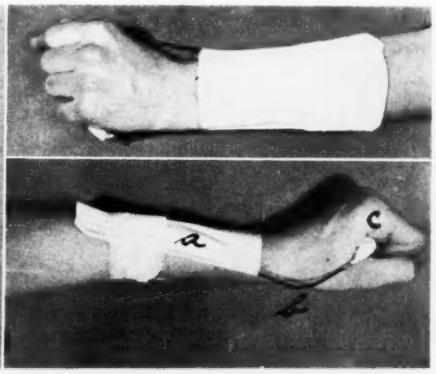


Fig. 4. Top view of splint in use.

Fig. 5.

Fig. 5. Side view of splint in use. For simplification the forearm bandage has been left off: *a*, apron; *b*, angulation point; *c*, handle bar.

The proximal cross-bar is bent in a curve to conform to the rotundity of the dorsum of the forearm. This will enable the splint to lie flat without shifting. A broad strip of certain amount of voluntary flexion is possible but the wrist immediately springs back into extension. Should more rigidity be desired, heavier wire may be used.

A NEW MECHANICAL FRACTURE SPREADER

F. T. BRENNER, M.D.
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TRACTION and fixation are the two necessary principles for proper reduction of every fracture. Temporary traction alone does no good unless the fragments can be held firmly in proper position. Also it is necessary that the associated muscles be in relaxation while traction is on. For accurate adjustment we must be able to view the position of fragments with the fluoroscope at any angle without disturbing their allignment while reduction is being done.

Repeated *x*-ray pictures, and then a little more adjustment is too time-consuming and expensive. Therefore, your instrument must not be in the way of the fluoroscope. The instrument must also be entirely out of the way of plaster cast application. The instrument here illustrated, and as shown further in the text, covers all of these requirements.

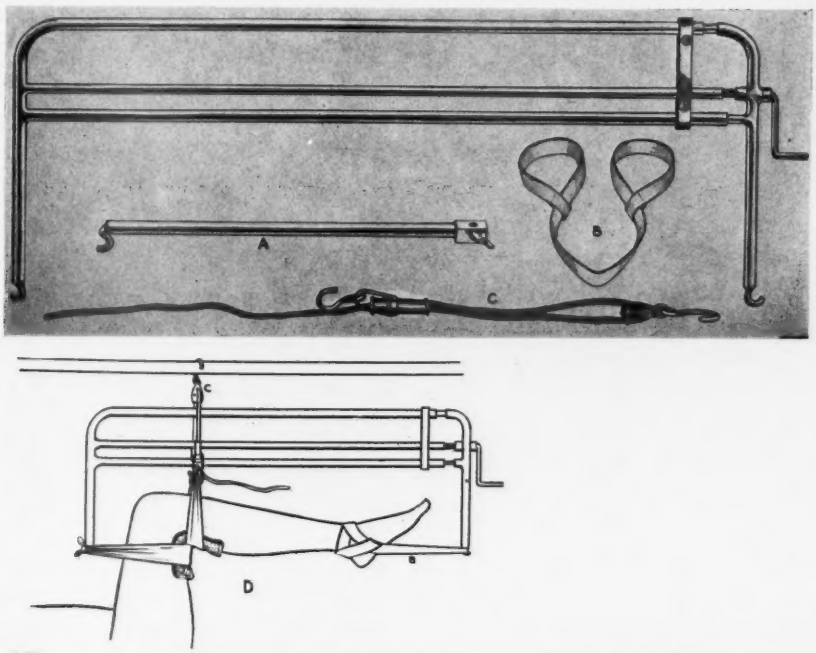

FIG. 1. Fracture reduction apparatus and accessories. The double arm with the traction screw represents the complete instrument as shown in insert. A, the extension piece to be used when a wider spread is desired; B, Brenner ankle or wrist hitch. The two loops slip over ankle and are drawn taut. C, Brenner overhead pole hitch with automatic lock and pulley to suspend leg while under reduction or cast. D, Insert,—showing complete action on leg fractures.

The principle is simple: There are two arms that are separated by screw action, guided by trombone action of the two sleeves. The hitch or cord makes the pull from the arm hooks. It is made with an easily detachable extension piece permitting a spread of 6½ feet or more. Only seldom is it necessary to use this extension, that is, when it is desired to make traction on a tall adult with one hitch in the groin and the other from the ankle.

Ordinarily one will prefer to make traction with the knee flexed in order to relax

the muscles better, either for a femoral fracture or a fracture of the lower leg. With the knee flexed the extension piece is not needed.

For a fracture of tibia or fibula a heavy piece of felt is placed under the knee and the flexed leg is suspended by this from an overhead pole by pulley cord which automatically locks in any position.

If hitch traction is desired, the leg is suspended as before. Another felt pad is placed under the leg just above the knee, and this hitch is hooked to one arm of the tractor. The other tractor arm is hooked to Brenner's ankle hitch. A few turns of the traction screw—measured by the scale—brings the fragments in line.

The fracture spreader can be swung around, up or over, or to one side, perfectly out of the way of the fluoroscope for any view. The splints or cast can then be applied with no interference from the instrument. In order to make traction with the knee in extension, one hitch is placed in the groin and the other on the ankle. Now the extra extension piece is used, quickly attached and firmly held by a single friction lock.

Forearm Fracture. A Brenner hitch is placed on wrist and a felt pad is placed above the elbow with the elbow flexed at 90 degrees; or the arm is extended with one hitch in the axilla and the other on the wrist.

Humerus. One hitch is placed in the axilla and the other at the bend of the elbow, or pin hitch.

Hip Dislocation. A felt pad is placed below the knee with the knee sharply flexed. The other hitch is applied in front of the groin with the hook behind the buttocks. Then while traction is on the flexed leg can be manipulated similar to the Kocher shoulder dislocation technic. The spreader* swings around with the leg to any position without lessening the pull. Whenever bone pin traction is desired, a double loop can be made with a piece of strong cord; hook a loop over each end of the pin. The double loop is then attached to each spreader hook and traction made as before. The cord remains on the pin and is included in the cast. This is the ideal method by far.

Brenner suspension pole hitch is a great convenience to suspend the leg in any desired degree of flexion, either while reducing the fracture or while putting on the cast. The large hook hangs from an overhead pole. The rope from the pulley has an automatic lock attachment. A simple pull suspends the leg and holds it there. There is no tiring effort or shifting of position as when held by an assistant.

The *Brenner ankle or wrist hitch* is made of strong two-inch web strap. It automatically adjusts itself to an infant or adult wrist or ankle. The strap lies flat and does not cut by wrinkles or creases. It will not slip, is easy to put on and is easy to remove.

* This instrument is light, easily portable, adapted to any long bone fracture and after adjustment is entirely mechanical. It swings out of the way of fluroscope and cast without disturbing the fracture allignment and pull. It is suitable for either hitch or bone pin traction. Scale to measure traction.

A TUBAL INSUFFLATION METHOD

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THE Rubin test for patency of the fallopian tubes is a method of passing gas through the cervix, fundus and tubes, into the abdomen.

Experience has demonstrated that "room air" has several characteristics which make its use objectionable. Air contains nitrogen, which is absorbed slowly. The discomfort following its use is, therefore, somewhat long-lasting and air is theoretically more apt to cause gas embolism.

Carbon dioxide, being more rapidly absorbed, shortens discomfort time and lessens the possibility of gas embolism; however, the carbon dioxide apparatus as now available is expensive and more or less complicated.

The Dickinson modification of the Rubin insufflation apparatus is simple and efficient.* It consists of a rubber bulb with a thumb operated release, a pressure gauge and a cervical cannula, all connected with rubber tubing. It lends itself well to office use, but uses ordinary room air.

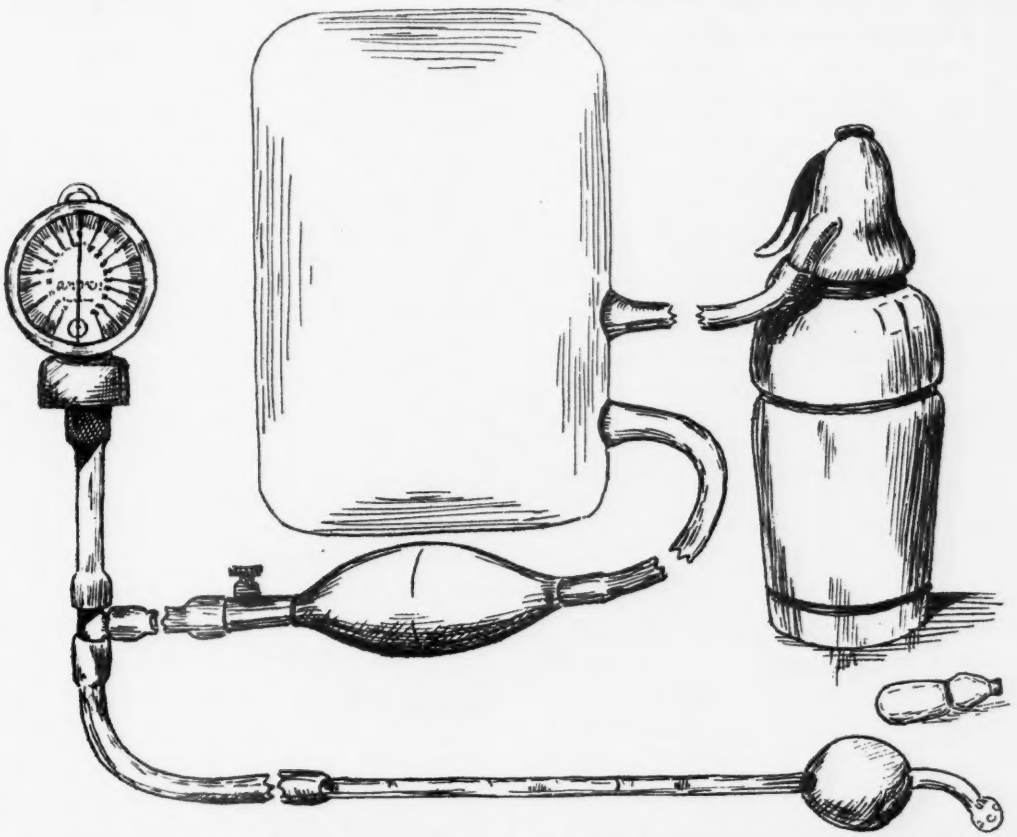


FIG. 1. Carbon dioxide released from the dry syphon partly inflates the rubber bag. With the hand bulb the operator pumps the carbon dioxide from the bag into the uterine cannula as he checks the pressure on the manometer.

The author's instrument (Fig. 1), utilizes the cannula, pressure gauge and rubber bulb described by Dickinson. In addition to these, facilities are provided for supply-

* Robert L. Dickinson. Nelson Looseleaf Surgery, p. 751, 1929.

ing carbon dioxide under low pressure instead of air. This gas may be pumped into the uterus as desired, using the rubber bulb in the same manner as for air. An ordinary household syphon supplies carbon dioxide from a small cartridge. The arm band from a blood pressure instrument provides a reservoir for the gas. One of the rubber tubes is attached to the syphon. The other tube is attached to the rubber bulb by means of a metal connection which has been soldered to the intake valve of the bulb. The pressure gauge is attached to one side of a "T" tube, and indicates the pressure caused by the bulb as gas is pumped to the uterus.

METHOD OF USE

The dry syphon is filled with carbon dioxide from a new gas cartridge. The syphon handle is pressed for a moment to remove the air from the instrument and to fill with carbon dioxide. The sterile cannula is inserted into the cleansed cervix and the syphon handle is pressed to deliver carbon dioxide into the rubber bag. Then, with the bulb, the carbon dioxide is pumped into the uterus slowly, while the pressure gauge is being watched. Thus, carbon dioxide is supplied instead of air.

This method avoids the use of gas pressure tanks and complicated valves, with danger of sudden pressure increase. The carbon dioxide is released into the rubber bag and there stored at low pressure until pumped by the hand bulb into the uterine cavity.

Correct pressure control is checked by means of the gauge and the hand bulb is used precisely as is done when the air instrument is used.

Bookshelf Browsing

SURGEON JOHN JONES, U. S. ARMY

FATHER OF AMERICAN SURGERY AND AUTHOR OF AMERICA'S FIRST SURGICAL BOOK

COLONEL EDGAR ERSKINE HUME, M.C.
United States Army
CARLISLE BARRACKS, PENNSYLVANIA

AMONG the great things which medical officers of the United States Army have contributed to science are three books, each a milestone in its particular field. They are (a) the first American book on surgery, by Surgeon John Jones (1729–1791) which was published in 1775; (b) the first American pharmacopœia, by Physician General William Brown (1748–1792) which appeared in 1778; and (c) the first American textbook on bacteriology by Surgeon General George Miller Sternberg (1838–1915), which came out in 1884. The first American publication on vaccination, by Surgeon Benjamin Waterhouse (1754–1846) appeared in 1799, and might be added to this list, though it was a short communication and not a book. One must also, in consideration of priorities, give paramount place to the *Index Catalogue* of the Army Medical Library, America's greatest contribution to bibliography and the greatest catalogue of all time.

The earliest of these books is the monograph of Surgeon John Jones. This work and its author are not as well known as they deserve to be. The book is at once the first medical book by an American, the first American work on surgery, and the first work on hygiene that our country produced. Hygiene is contained in an Appendix. "At the commencement of the Revolutionary War," said Billings in his *A Century of American Medicine* (1876), "we had only one book by an American author, three reprints, and about twenty pamphlets." This unique book was Jones's monograph.

Jones's book bears the lengthy title usual in the eighteenth century: *Plain Concise Practical Remarks on the Treatment of Wounds and Fractures; To which is Added a Short Appendix on Camp and Military Hospitals; Principally Designed for the Use of Young Military Surgeons in North America.* New York, 1775, 92 pages.

The author, an Army medical officer, was one of the great American surgeons of the period. He was a founder and the first Vice-President of the College of Physicians of Philadelphia, a founder and Professor of Surgery at King's College (now Columbia University), and a founder and the designer of the New York Hospital. When we add these to his having written the first American medical book, we cannot help but recognize Jones as one of the great men of his day.

BIRTH

John Jones was the son of Dr. Evan Jones and Mary Stephenson. His grandfather was Dr. Edward Jones, whose wife, Mary, was the eldest daughter of Dr. Thomas Wynne, one of William Penn's fellow passengers in the *Welcome*. John Jones was born at Jamaica, Long Island, in 1729. All four of his grandparents belonged to the Society of Friends and were

born in Wales prior to 1682. In that year Dr. Edward Jones settled with his family in Merion Township, County of Philadelphia, Pennsylvania.

Young John Jones, after early education from his parents and at a private school in New York, began the study of medicine in Philadelphia. It was under the direction of Dr. Thomas Cadwallader (1708–1779)* and his own father, who practiced medicine in Philadelphia for a time before he removed to Long Island.

STUDIES IN EUROPE

Jones keenly felt the lack in this country of free institutions for the care of the sick, wherein the practice of medicine could be learned by practical methods at first hand. He therefore did what most of the better educated physicians of his day did. He went to Europe for further study. He was first at London where he attended the lectures of John Hunter (1728–1793) (who it will be remembered was himself a military surgeon, having served as Deputy Surgeon General of the British Army in 1786), James McKenzie (1680–1761) and other shining lights of the day. He likewise followed the practical clinical work in several hospitals, particularly Saint Bartholomew's, at which Percival Pott (1714–1788) (of Pott's fracture and Pott's disease) was senior surgeon, then at the peak of his reputation.

After some months in London, Jones went to France for further study. His thesis, *Observations on Wounds*, was published in New York in 1765, it is said, but no copy is known. He obtained his degree of Doctor of Medicine at the University of Rheims in May, 1751. Both before and after that date he studied at Paris where he remained until April, 1752. In Paris he followed the anatomical lectures of Jean-Louis Petit (1674–1750) as well as the clinical work at the Hôtel Dieu, where Claude-Nicolas Le Cat (1700–1768) and Henri-François Le Dran (1685–1770) were then the leading surgeons. Afterward he spent some months at the University of Leyden where the great Boerhaave was his preceptor. Later he was for some months in Edinburgh where he completed his medical education, studying under the elder Alexander Monro (1697–1767). Certainly one must reckon John Jones an unusually well educated man.

Commenting on Jones's European training, his pupil and biographer, Dr. James Mease (1771–1846), who himself served in the War of 1812 as Hospital Surgeon, U. S. Army, said:

"Under masters like these, and enjoying such opportunities, he could not fail, with the assiduity which he employed, of acquiring all the knowledge of that time to be obtained: in consequence of the zeal which he showed in the acquisition of every species of useful knowledge, he attracted the notice of the above celebrated surgeons, which was of essential benefit to him, in the prosecution of his studies; to Mr. Pott, in particular, he considered himself under peculiar obligations, for the marks of friendship he experienced from him, and which could not fail to inspire him with a love of his profession.

"During the prosecution of his studies in Europe, Dr. Jones was industrious in collecting all the useful information in his power, especially upon those branches of science more immediately connected with his profession. To anatomy, as the handmaid of surgery, and the basis of medical science, he paid the greatest attention, but he did not suffer this to engross the whole of his time: convinced of the intimate connection between the different branches of the profession, he considered the separation of them, not only as contrary to nature, but as highly detrimental to the progress of the science; and therefore believed, that a knowledge of one part was indispensably

* Thomas Cadwallader was John Jones's first cousin, the former's aunt being the latter's mother. Cadwallader was educated in Europe and became one of the physicians of the Philadelphia Hospital at its establishment in 1752. He was a pioneer in inoculation. He is best known for his *Essay on the West-India Dry-Gripes*, printed by Benjamin Franklin in 1745. It is the first account of lead poisoning from rum distilled through lead pipes. He was twenty years older than Dr. Jones.

requisite to a right understanding of the other."

PRACTICE OF SURGERY IN NEW YORK

With the medical learning and skill he had gained in Europe, Jones began practice of surgery in New York. He early acquired a reputation as a skillful and speedy operator. This last was of paramount importance in those days of no anesthetics. Dr. Jones was the first surgeon to perform the operation of lithotomy in New York, and on this success much of his fame was built. He required but three minutes for the operation. "This operation," says Mease, "had likewise been frequently attempted in the other states, but the want of success attending it, was generally so great, as to prevent it from being performed in future: the fortunate manner, however, in which those cases under his care succeeded, fully proved, that it was no longer the dangerous operation many had been made to apprehend, and which induced them rather to submit to a miserable life, than suffer the risque of falling a sacrifice to the means instituted for their relief."

SERVICE IN THE FRENCH AND INDIAN WAR

In 1758, there burst forth in the British Colonies of North America that phase of the Seven Years' War which is usually known as the French and Indian War. Early in the conflict a report reached New York City of the intended attack of the enemy upon the frontiers of the Colony. Dr. Jones at once offered his services as a volunteer surgeon to the troops raised for the Colony's defense. He served in this capacity until the end of the war.

His reputation was so well established that he was well known to the French commander, General d'Escaux, who was dangerously wounded during the severe repulse suffered by the French in the engagement at Lake George, with the British and Colonial troops under Sir William Johnson. General d'Escaux, a prisoner of war, asked that he be placed under the care of Surgeon Jones while being treated for his wound. This was done and Jones attended him for a considerable time. At the close of the French and Indian War, Jones returned to private practice in New York City, his reputation being much increased by his military service.

FIRST PROFESSOR OF SURGERY AT KING'S COLLEGE

In 1767, the medical school of King's College, New York, was created. It was America's second pioneer school. This institution is now Columbia University. Jones was appointed the first occupant of the chair of surgery, thus becoming the second full professor of surgery in the country.* He was associated in the launching of the new medical school with such men as Samuel Bard (1742–1821) whose *A Discourse upon the Duties of a Physician* (1769), is the first American publication on medical ethics, and Peter Middleton (–1781) whose *A Medical Discourse or an Historical Inquiry into the Ancient and Present State of Medicine* is America's first book on medical history (1769).

As a professor, Jones displayed the ability of transmitting to his students the results of his own experience as well as of his European studies. He delivered his introductory address on November 9, 1767. "He endeavoured," we read, "to instill into the minds of his pupils the same just principles that guided his conduct. . . . Viewing the science in an enlarged and honourable light, as comprehending the most extensive view of our nature, and as tending to the alleviation and abridgement of human misery, he taught his pupils to despise the servile conduct of those who consider the profession as worthy of cultivation, only in proportion to the emoluments which it yields; and to rely upon the solidity of their own endowments, as

* The first professor of surgery in what is now the United States was Dr. William Shippen (1736–1808), sometime Director General of Military Hospitals of the Continental Army. He was appointed Professor of Surgery at the College of Philadelphia (now University of Pennsylvania) in 1766.

the best security of general esteem, and for the acquisition of business." (Mease) Translated into twentieth century expression, we gather that Dr. Jones was a man of correct conduct and teaching.

JOHN JONES M.D.

FIG. 1. Portrait of Surgeon John Jones of the Continental Army. (From Mease's biography of Dr. Jones.)

INTRODUCTORY LECTURE, KING'S COLLEGE, 1769

Mr. W. B. McDaniel, 2d, Librarian of the College of Physicians of Philadelphia, has published the full text of Jones's first lecture delivered at King's College, 1769, together with interesting notes. McDaniel calls attention to the rarity of manuscripts of the didactic lectures which were the customary method of teaching medicine in Jones's day, and for a long time thereafter. It is, therefore, most interesting and fortunate that this valuable manuscript has been preserved in the Library of the College of Physicians of Philadelphia. The volume containing it has also the nine later lectures of John Jones and his notes on the lectures of William Hewson (1739–1774). The manuscript volume was presented to the Library in 1902 by Dr. George W. Norris, to whom it had been presented, as a penciled note states "by Mrs. Randolph." On the fly-leaf, in ink, in the manner of a title-page, is written: "Lectures on Surgery by the late John Jones, M. D., presented to me by Mrs. Clark." McDaniel thinks this is in the handwriting of Dr. James Mease, whose signature appears in the upper right-hand corner.

"The Introductory Lecture (of Jones) may be regarded as a companion piece to Peter Middleton's *Medical Discourse or an Historical Inquiry into the Present State of Medicine*, delivered at the opening of the medical school of King's College and printed in 1769; and to Samuel Bard's *First Commencement Address*, printed in the same year." (McDaniel)

Parts of this Introductory Lecture are almost the same as passages used later by Jones in his book. There are also other bits of advice to future practitioners which make good reading even today. For instance:

"This ancient branch of medicine called Surgery, according to the strict grammatical meaning of the word, signified manual operation, but the science & art of surgery, tho' more clear & certain in its objects, than that of Physic, is equally various, extensive & difficult of attainment. And I have ever been of opinion that young Physicians might lay the foundation for medical knowledge, by an attentive observation of those disorders, which surgery presented to their view. For most of those diseases, which are incident to the viscera & internal parts, are seen upon the external surface of our bodies, & are obvious to the senses, and the curative indications, as well as methodus medendi, in both have a very close analogy."

It had not been long since the surgeons were separated from the barbers, so that we are not surprised to read this conclusion to Jones's Introductory Lecture:

"To conclude, Gentlemen, if the science of surgery, then, requires genius, knowledge, & indefatigable application, to render its Professors truly respectable, what must we think of the insolence & malevolence of

those who represent it as a low mechanical art, which may be taught a butcher's boy in a fortnight—yet such false & absurd representations have been made of it, by some who have enjoy'd no small share of medical reputation in this country, & what is equally reproachful, there have been men who stil'd themselves gentlemen, ignorant & weak enough to credit such absurdities."

Jones continued his annual lectures until interrupted by the American Revolution.

FOUNDER OF THE NEW YORK HOSPITAL

In 1770, Dr. John Jones, with his fellow professor at King's College, Dr. Samuel Bard (1742–1821), and others petitioned King George III, through the Governor, John, Earl of Dunmore, for a charter for a hospital. The city of New York was then a town of about 20,000 inhabitants, scarcely extending as far north as St. Paul's Church. Jones and Bard had urged the hospital at the commencement of King's College in Trinity Church on May 16, 1769, and at their instance the Governor of the Province of New York, Sir Henry Moore, opened a subscription. Nearly a thousand pounds were raised in this way.

At the first meeting of the Governors of the New York Hospital, held in Bolton's Tavern on Wednesday, July 24, 1771, the charter was produced and read and the new institution formally came into being. On October 25, 1774, they appointed as their "Physicians in Ordinary" Doctors Peter Middleton, John Jones, Samuel Bard, and Malachi Treat.

The Minutes of the Governors of March 27, 1772, empowered, under the seal of the corporation, Dr. John Jones, then "intending for Europe," to make collections of money, and to buy medicines and apparatus abroad. The Secretary was directed to advertise in the public papers for plans. On July 2, 1773, the Governors ordered that the plan brought from England and laid before the Board by Dr. Jones, be carried into execution. They undertook but one story at first, for their finances were low. Jones had carried out the wishes of the Governors while in London and, despite his impaired health, had been able to collect moneys for the hospital.

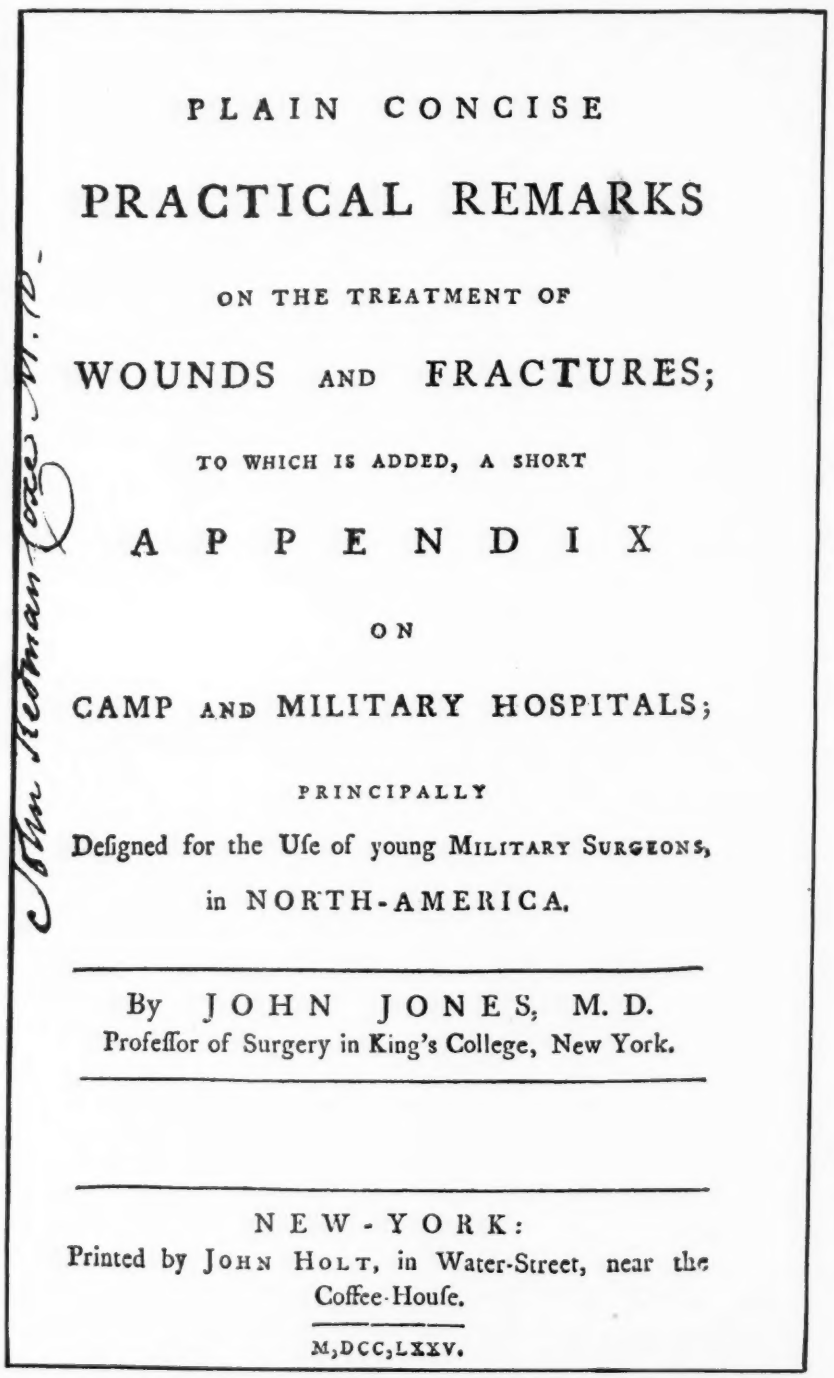
Jones gave sound advice as to the construction of the new hospital. He had seen the terrible conditions at the Hôtel Dieu in Paris, where he found beds placed in triple rows, with four to six patients in each bed, and where more than once on the morning rounds he saw the dead lying with the living. The mortality, he said, was one-fifth of the whole number of patients received. He wrote to the Governors, "It is to be hoped that the hospital lately built in the City of New York will have fewer objections to its plan than any hospital hitherto constructed. The principal wards, which are to contain not more than eight beds, are thirty-six feet in length, twenty-four feet wide and eighteen high. They are all well ventilated, not only from the opposite disposition of the windows, but proper openings in the side walls, and the doors open into a long passage or gallery, thoroughly ventilated from north to south.

"If great and populous cities have been justly styled the graves of the human species, the large and crowded hospitals generally built in them may with equal truth be deemed the lazarettos or pest houses of the most unfortunate persons, who, from ill directed motives of compassion, are carried into these charities." (From the Appendix to Jones's *Plain Concise Remarks*, etc.)

One of the medical tragedies of the period is the destruction by fire of the New York Hospital. "On Tuesday last," says the *New York Gazette and Weekly Mercury* of March 6, 1775, "between twelve and one o'clock, the new hospital at Ranelagh, a large pile of buildings lately erected and nearly finished, was discovered to be on fire, the workmen being all gone to dinner, and the whole wooden part of the building was, in about an hour, reduced to ashes." The building was rebuilt but it was January 3, 1791, a few months before Jones's death, before the wards were actually open for the reception of patients.

SECOND VISIT TO BRITAIN

Jones, we are sad to read, was an asthmatic. He had "long struggled to overcome that painful disease," but "the exertions of both his own skill, and of the rest of his medical brethren, in most parts of the continent" had unfortunately "proved ineffectual towards even his relief." Therefore, he decided on a voyage to Europe for his health, and sailed for London.



PLAIN CONCISE

PRACTICAL REMARKS

ON THE TREATMENT OF

WOUNDS AND FRACTURES;

TO WHICH IS ADDED, A SHORT

APPENDIX

ON

CAMP AND MILITARY HOSPITALS;

PRINCIPALLY

Deſigned for the Uſe of young MILITARY SURGEONS, in NORTH-AMERICA.

By JOHN JONES, M. D.
Profeſſor of Surgery in King's College, New York.

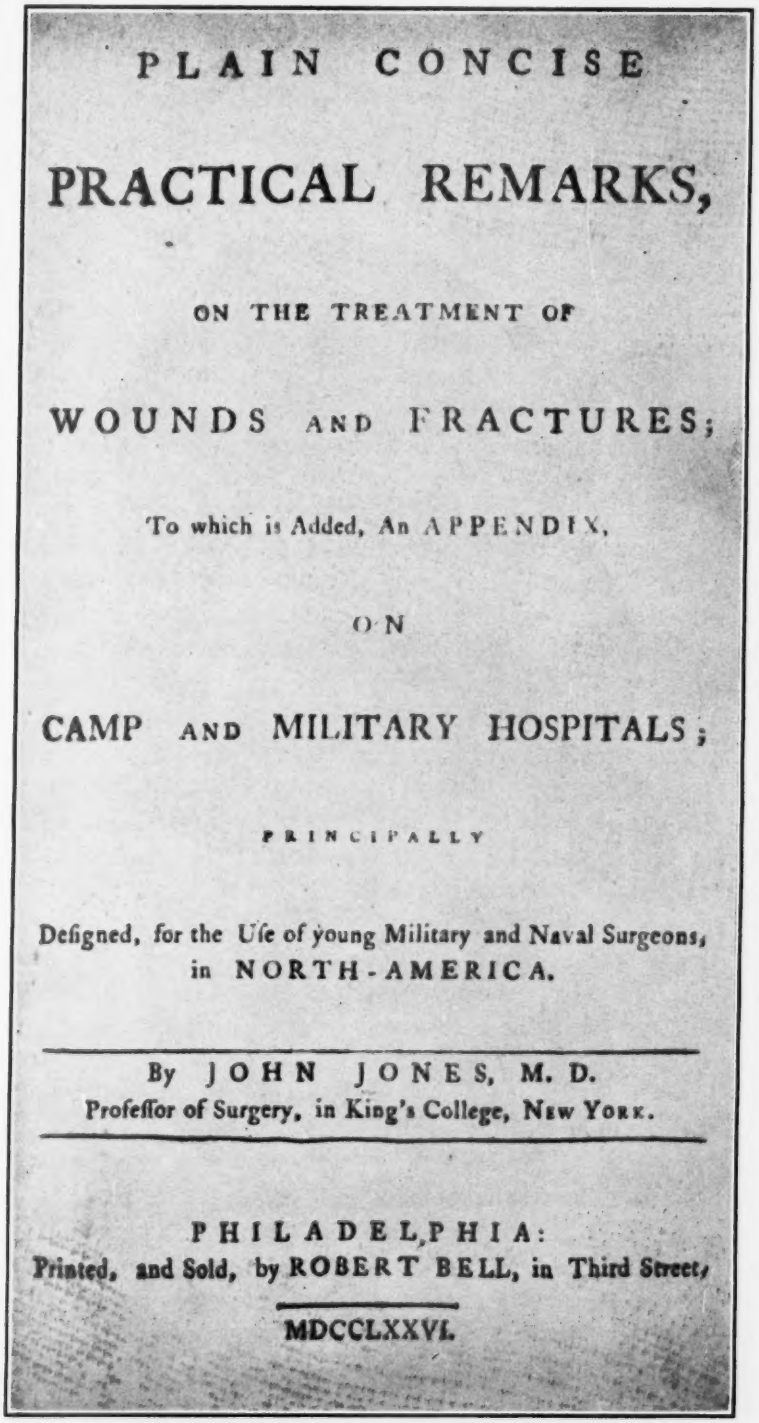
NEW-YORK:
Printed by JOHN HOLT, in Water-Street, near the Coffee-Houſe.

M,DCC,LXXV.

FIG. 2. Title page of the first edition of Surgeon Jones's Monograph, 1775. This is the first American medical book.

One may not quite follow the therapeutic advice on which this was based. In London, wrote Mease, "in the thick smoke, and an atmosphere impregnated with every species

of animal putrefaction and effluvia, where so many asthmatics have found such remarkable benefit, he also experienced a considerable alleviation of his complaint." Indeed his improved state of health for the remainder of his life was attributed to the health-giving air of London!



PLAIN CONCISE

PRACTICAL REMARKS,

ON THE TREATMENT OF

WOUNDS AND FRACTURES;

To which is Added, An APPENDIX,

ON

CAMP AND MILITARY HOSPITALS;

PRINCIPALLY

Designed, for the Use of young Military and Naval Surgeons, in NORTH-AMERICA.

By JOHN JONES, M. D.
Professor of Surgery, in King's College, New York.

PHILADELPHIA:
Printed, and Sold, by ROBERT BELL, in Third Street,

MDCCLXXVI.

Fig. 3. Title page of the second edition of Surgeon Jones's Monograph, 1776. Published one year after the first edition, the book is now designed for the use of naval as well as military surgeons.

In London, he had once more the privilege of seeing some of his old mentors, particularly Percival Pott. Jones, we learn

with pleasure, "unlike many who suppose all knowledge to become stationary at the time of their leaving college, was still willing to be taught by those who had formerly been his instructors." Full well did he realize that they "from the greater opportunities they enjoyed, would be able to afford him much information."

Jones visited John Hunter again and met with a cordial reception. From Pott he received a complete copy of his celebrated lectures. Pott also made a practice of recommending Jones to those who wrote him for his opinion, and to travelers destined for New York. This had much to do with the spread of Jones's fame.

AMERICA'S FIRST SURGICAL BOOK

In 1775, he wrote his *Plain Remarks upon Wounds and Fractures*, which he inscribed to Dr. Thomas Cadwallader, his kinsman and preceptor. The book was a welcome one indeed. It contains much material based on Pott's teachings, and that of other of Jones's European professors. Jones drew somewhat, also, on the work of John Ranby (1703–1773), Serjeant-Surgeon to the King. It will be recalled that in 1745 Ranby had been responsible for the act that formally separated the surgeons from the barbers as "Masters, Governors, and Commonality of the Art and Science of Surgeons of London," which later became the Royal College of Surgeons of England.

For all this, Jones's book contained original observations. "Few presents could have been more acceptable to his country, or more opportunely made; for, in the then situation of American affairs, many persons were chosen to act as surgeons, who from their lamentable ignorance of the principles of their profession were but ill qualified for the office." Billings notes Jones's having called attention to *hernia cerebri* following trephining.

It was immediately hailed as a valuable and timely work, a veritable *vade mecum*. The War for Independence was beginning and among the many needs of the new army was a great demand for surgeons. There were comparatively few possessors of medical degrees in the Colonies at that time, though many other persons practiced medicine without degrees. Unfortunately for the medical service, many of the best qualified physicians became officers of the line instead of performing medical duties. For instance, General Warren, who fell at Bunker Hill, General St. Clair, who commanded Pennsylvania troops, General Hugh Mercer, who fell at Princeton, Colonel Theodoric Bland of Virginia, and many more, were physicians.

The value of Jones's monograph was enhanced by binding with it his translations of Gerard L. B. van Swieten's (1700–1772) *Diseases Incident to Armies*.

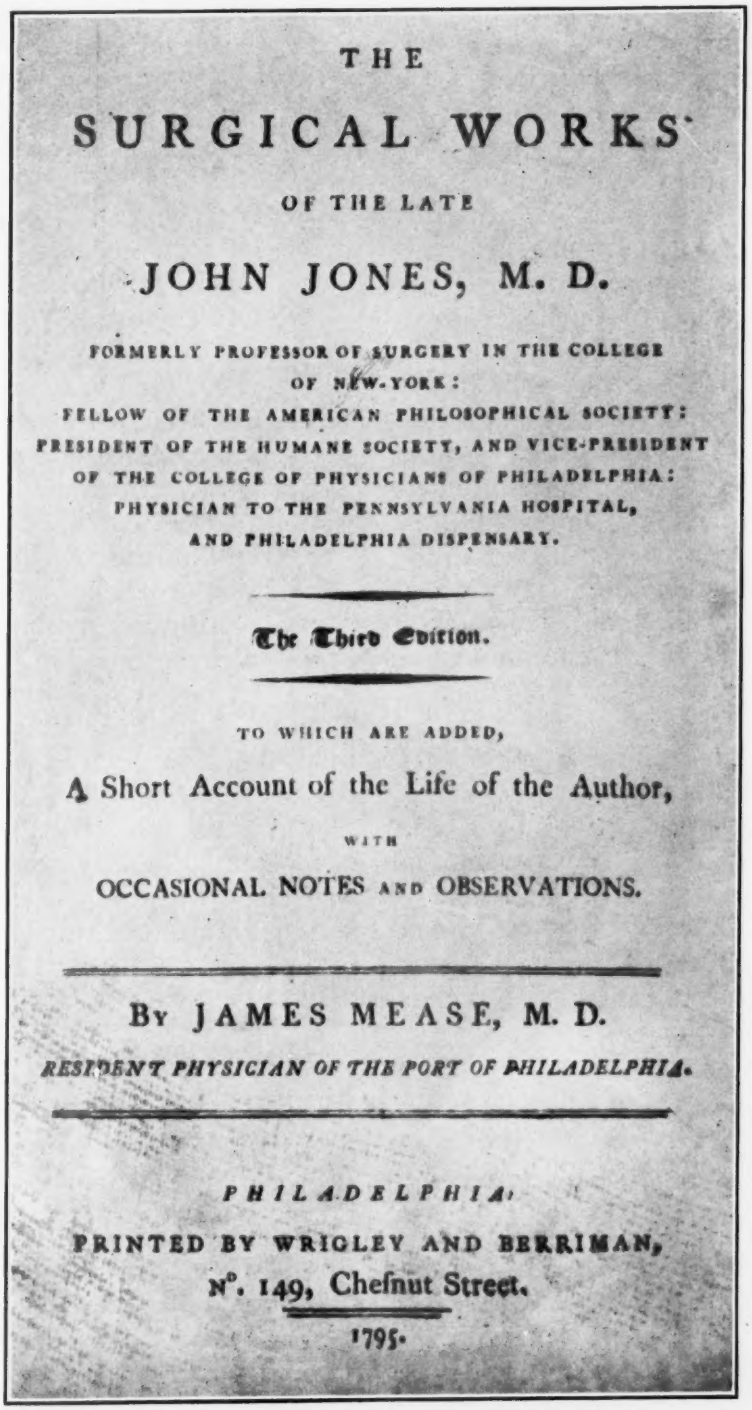
A second edition appeared in the following year: "Plain, Concise, Practical, Remarks on the Treatment of Wounds and Fractures; To which is Added, an Appendix on Camp and Military Hospitals. Principally designed for the use of young Military and Naval Surgeons in North America. Philadelphia, R. Bell, 1776," 114 pages. Four years after his death a third edition was published by Jones's friend Dr. James Mease (1771–1846). It is entitled:

"The Surgical Works of the late John Jones, M.D. Formerly Professor of Surgery in the College of New York, Fellow of the American Philosophical Society, President of the Humane Society, and Vice-President of the College of Physicians of Philadelphia, Physician of the Pennsylvania Hospital, and Philadelphia Dispensary. The third edition. To which are added a short account of the life of the author with occasional notes and observations. By James Mease, M.D., Resident Physician of the Port of Philadelphia. Printed by Wrigley & Berriman, Philadelphia, 1795." A copy of this work, presented by the author, is in the collection of the Library Company of Philadelphia.

Jones's attitude toward his duty as a military surgeon is reflected in his dedication of his famous book to his preceptor and cousin, Dr. Thomas Cadwallader: "If I cannot cure the fatal diseases of my

unfortunate country, I can at least pour a little balm into her bleeding wounds."

a surgeon, and on the duties of that profession. He says:



THE

SURGICAL WORKS

OF THE LATE

JOHN JONES, M. D.

FORMERLY PROFESSOR OF SURGERY IN THE COLLEGE OF NEW-YORK: FELLOW OF THE AMERICAN PHILOSOPHICAL SOCIETY: PRESIDENT OF THE HUMANE SOCIETY, AND VICE-PRESIDENT OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA: PHYSICIAN TO THE PENNSYLVANIA HOSPITAL, AND PHILADELPHIA DISPENSARY.

The Third Edition.

TO WHICH ARE ADDED,

A Short Account of the Life of the Author,

WITH

OCCASIONAL NOTES AND OBSERVATIONS.

BY JAMES MEASE, M. D.

RESIDENT PHYSICIAN OF THE PORT OF PHILADELPHIA.

PHILADELPHIA:

PRINTED BY WRIGLEY AND BERRIMAN,

No. 149, Chesnut Street.

1795.

FIG. 4. Title page of the third edition of Surgeon Jones's Monograph, 1795. This final edition edited by Jones's pupil, Dr. James Mease, appeared four years after Jones's death.

In the introduction to his book, Jones gives the student and others some sound advice as to the proper manner of becoming

"It will appear very evident how necessary it is for the student in Surgery to make himself thoroughly acquainted with

most of those branches of medicine, which are requisite to form an accomplished physician.

"Besides a competent acquaintance with the learned languages, which are to lay the foundation of every other acquisition; he must possess an accurate knowledge of the structure of the human body, acquired not only by attending anatomical lectures, but by frequent dissections of bodies with his own hands. This practice cannot be too warmly recommended to the students in Surgery: It is from this source, and a knowledge in hydraulics, they must derive any adequate notions of the animal œconomy of Physiology. Chymistry and Materia Medica are very necessary to a right understanding of pharmacy or composition. To these should be added some progress in the mathematics and mechanics, which I will venture to assert, may be applied with much more utility and safety to the science of Surgery, than Physic. But there must be a happiness, as well as art, to complete the character of the great Surgeon.

"He ought to have firm steady hands, and be able to use both alike; a strong clear sight, and above all, a mind calm and intrepid, yet humane and compassionate, avoiding every appearance of terror and cruelty to his patients, amidst the most severe operations."

This sage council is as good today as when Jones gave it before the day of America's independence. He constantly urged thoroughness in study and practice. A superficial student will "not be likely to reap much benefit from scampering round the wards of an hospital, and reading a general system of Surgery." He says elsewhere in his text: "As to those gentlemen who will neither read nor reason, but practice as a venture, and sport with the lives and limbs of their fellow-creatures, I can only, with Dr. Huxham, advise them seriously to peruse the fifth Commandment, which is 'Thou shalt not kill.'" On the other hand "knowledge ripened by experience" is a "proper requisite of a good surgeon." To practitioners in the new country, where opportunity is not within the reach of every student, he "earnestly recommends a diligent, attentive and repeated perusal of the best English writers."

Though it is impracticable to give lengthy extracts from the text of Jones's monograph, the titles of the chapters give an insight:

I. Of Wounds in General
II. Of Inflammation
III. Of the Division of Wounds
IV. Of Penetrating Wounds of the Thorax and Abdomen
V. On Simple Fractures of the Limbs
V. On Compound Fractures [There are two chapters numbered v.]
VI. On Amputation
VII. Of Blows on the Head
VIII. On Injuries Arising from Concussion or Commotion
IX. On Injuries Arising from a Fracture of the Skull
X. Of Gunshot Wounds

To this is added the famous appendix, the first American text on hygiene. It is entitled: "An Appendix Containing Some Short Hints on the Structure and Œconomy of Hospitals; Particularly Applied to Military Ones, with the General Means of Preserving Health in an Army." The appendix is twelve pages in length.

MEMBER OF THE NEW YORK SENATE

When the war that was to result in American independence began, Jones threw his considerable influence toward the party that insisted on the rights of the Colonists. When New York was occupied by the British Army, Jones escaped and shortly afterward became a member of the New York Senate. He served in this capacity as long as he believed that he was of use and then resigned so as to enter the military service.

MILITARY SERVICE IN THE AMERICAN REVOLUTION

Following his service as a member of the New York Senate, Dr. Jones was appointed Surgeon's Mate of the Tenth Massachu-

setts Regiment of the Continental Line. A Surgeon's Mate in those days was what was later known as an Assistant Surgeon. On September 24, 1777, he was promoted Surgeon in the same regiment.

When Philadelphia was evacuated by the British troops in the summer of 1778, Surgeon Jones was sent there in an official capacity. This was much to his liking, not only on account of the importance of being in the metropolis of the country but because the climate seemed to improve his asthma. Whether this were on account of foul atmosphere similar to that of London in which he had improved, the record does not say.

Surgeon Jones continued in the military service until May 14, 1781, (Heitman) when he resigned and began the practice of medicine in Philadelphia, which was to remain his home for the rest of his life. His frail state of health prevented more active field service, but he is credited with an important share in organizing the medical department of the Continental Army. J. M. Toner. *Tr. Am. M. A.*, 29: 689, 1878.

JONES'S SUCCESS IN PHILADELPHIA

Jones met with the same success as a practitioner in Philadelphia that he had experienced in New York. "The same agreeable manners as a gentleman, which placed him so high in the esteem of his fellow-citizens at New York, could not fail of attracting those of his new place of residence," says Mease. He had been a member of the American Philosophical Society since his election on April 21, 1769. In January, 1786, he became a member of its council.

In 1780, he succeeded Dr. John Redman as one of the Physicians of the Pennsylvania Hospital. He held this position until his death. In the same year, he was elected a consulting physician of the Philadelphia Dispensary. When the Humane Society (for the resuscitation of drowned persons) was formed in 1780, Jones was elected its President. The other physicians who were members were Benjamin Rush, Benjamin Duffield, Caspar Wistar, Samuel Powell Griffits, and John R. B. Rodgers (American Museum, 1787). All of these memberships attest Jones's high place in the community.

VICE-PRESIDENT OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA

When the College of Physicians of Philadelphia was instituted in 1786, Dr. Jones was elected its first Vice-President, the Presidency being given to Dr. John Redman (1722–1808). By annual re-election, Jones held the office of vice-president to the end of his life, and might have succeeded to the presidency had he survived Redman. One of the best contemporary opinions of Jones is given in Redman's acknowledgment, August 2, 1791, of his re-election as President of the College.

Of his colleague, Jones, Redman said:

"I should not have been easy under the sense I had of my growing infirmities of body and mind for some time past, to have continued to accept the honor you have so repeatedly conferred upon me, but from the consideration that you always joined a colleague with me as Vice-President, whose eminence and reputation in our profession, and whose clearness of judgement, vigor of faculties, and easy manner of conveying his sentiments, together with his friendly disposition to aid me, fully obviated and prevented any ill effects, naturally to be expected from declining age, and rendered my situation more pleasant than otherwise it might have been. But though much and justly respected by us, and all connected with him in kindred, friendship, and business, he was mortal, and he has gone—no more to return, to aid by his talents, or gratify us by his presence at our meetings, or cheer us by his affability, agreeable converse, and polite manners. And, therefore (though somewhat late and unseasonable), I must indulge myself in sympathizing with you and regretting the real loss which the republic of medicine in general, and our collegiate society in particular, have sustained thereby. Much did I expect, from his being several years

younger than myself, and so well and justly esteemed by you, that he would be my next successor; and from a settled resolution soon to request my dismission (if not otherwise removed), I sometimes flattered myself with having the pleasure to see him raised to your presidential chair—to which I should most heartily have concurred—as well on account of his own merit and qualifications, as because it would have been highly gratifying to me to be a living witness of our College being headed by one whose eminence in more than one of the material branches of medical science, and reputation among our citizens in general was still very flourishing, and whose connection with and estimation in which he was held by the higher orders and rank of them, was so conspicuous and intimate, as might contribute to the greater external dignity of the institution, and render its influence more powerful and effectual on any particular occasion of public utility, wherein it might be thought requisite or be called upon to exert it." (*Transactions College Physicians Philadelphia*, 1887, 49–50.)

Jones contributed one of his most interesting papers, "A Case of Anthrax," to the first part of the first volume of the *Transactions of the College of Physicians*. (1793.) It was read posthumously.

BENJAMIN FRANKLIN'S PHYSICIAN

It is not surprising that so prominent a man as Jones has the greatest of Pennsylvanians as his patient. Benjamin Franklin was his intimate, personal friend and was under his medical care through the last years of his life. In his will, dated July 17, 1788, Franklin left Jones a bequest. Jones's friend, Dr. James Mease (1771–1846) who published memoirs of Jones's life, preserved the following brief account of Franklin's last illness. It was written down by Jones at the time and later published by him as "A Short Account of Dr. Franklin's last Illness," which appeared both in the *Pennsylvania Gazette* and *Freeman's Journal*, both of Philadelphia, for April 21, 1790. The following are passages:

"The stone, with which he had been afflicted for several years, had for the last twelve months of his life, confined him chiefly to his bed; and during the extremely painful paroxysms, he was obliged to take large doses of laudanum to mitigate his tortures; still, in the intervals of pain, he not only amused himself by reading and conversing cheerfully with his family and a few friends who visited him, but was often employed in doing business of a public, as well as of a private nature, with various persons who waited upon him for that purpose; and in every instance, displayed not only the readiness and disposition to do good, which were the distinguishing characteristics of his life, but the fullest, and clearest possession of his uncommon abilities. He also not unfrequently indulged in those jeux d'esprit, and entertaining anecdotes, which were the delight of all who heard them.

"About sixteen days before his death he was seized with a feverish disposition, without any particular symptoms attending it till the third or fourth day, when he complained of a pain in his left breast, which increased till it became extremely acute, attended by a cough and laborious breathing. During this state, when the severity of his pains drew forth a groan of complaint, he would observe, that he was afraid he did not bear them as he ought; acknowledging his grateful sense of the many blessings he had received from the Supreme Being, who had raised him from small and low beginnings, to such high rank and consideration among men: and made no doubt but that his present afflictions were kindly intended to wean him from a world in which he was no longer fit to act the part assigned him. In this frame of body and mind, he continued until five days before his death, when the pain and difficulty of breathing entirely left him, and his family were flattering themselves with the hopes of his recovery; but an imposthume [abscess] which had formed in his

lungs, suddenly burst, and discharged a quantity of matter, which he continued to throw up while he had power, but as that failed, the organs of respiration became gradually oppressed; a calm lethargic state succeeded; and on the 17th instant, [April, 1790] about eleven o'clock at night, he quietly expired, closing a long and useful life of eighty-four years and three months.

"It may not be amiss to add to the above account, that Dr. Franklin, in the year 1735, had a severe pleurisy, which terminated in an abscess of his lungs; and he was then almost suffocated by the quantity and suddenness of the discharge. A second attack, of a similar nature, happened some years after, from which he soon recovered; and did not appear to suffer any inconvenience in his respiration from these diseases."

Since Franklin remembered Jones in his will, we conclude that he had forgotten his own advice "He is a fool that makes his doctor his heir." (Poor Richard, 1733.)

DEATH OF JONES

President Washington and his family were patients of Dr. Jones. Indeed it was while on a professional visit to the Father of his Country, that Jones was stricken with his own last illness. He had been to see General Washington on the evening of June 17, 1791. It was a cool evening after a sultry day. "Dr. Jones was dressed in a light manner, suitable to the weather, when he set out; but it was not sufficiently warm for the remarkable and sudden alteration in the temperature of the air that succeeded." Feeling indisposed on his return home, he awoke next morning "with considerable fever, attended by diarrhœa, and great prostration of strength." (Mease.) There was a return of his old asthma, and the "conversation of his numerous friends who had visited him" added to the depletion of his strength. He became weaker and weaker and finally passed away in his sleep on June 23, 1791, being sixty-three years of age.

PERSONAL APPEARANCE

Jones was of about middle size, his "habit being thin, owing to his constant affliction with asthma." He had a quick and penetrating eye and a "cheerful but sedate countenance." His gravity of appearance and dignity never failed to command respect.

PROFESSIONAL POSITION

Best known as a lithotomist, he was a general surgeon and stood at the head of his profession in the United States. His technic of lithotomy became generally accepted and had much to do with the reduction in mortality that had theretofore attended the operation. He was likewise highly respected as an obstetrician. He is said to have given the first systematic instruction in midwifery to medical students in this country. He opposed the then too general use of drugs, being "convinced that nature, or more properly speaking, the exertions of the system, were, in the greatest number of instances, sufficient for its own necessities." Though educated in the school of Boerhaave, he never gave himself to any particular "system." He was ever ready to accept any rational method of treatment which had the sanction of experience.

Dr. S. Weir Mitchell, in his Commemorative Address at the centennial of the College of Physicians of Philadelphia, thus sums up his opinion of Jones:

"John Jones was of the Society of Friends, and lies, since 1791, after their fashion, in a nameless grave under the maples of their Arch Street burial ground. He was a man tranquil of temper, easy and polite, fond of poetry and belles-lettres, a surgeon so expert in lithotomy that he frequently operated for stone in a minute and a half."

"He was," says Ruschenberger, "generally considered to be the foremost American surgeon of his day, noted for the prudence of the plan and the celerity of his operations, a quality very highly valued before the introduction of anaesthetics.

"Few persons possessed more of those engaging qualities which render a man estimable, both professionally and otherwise, than Dr. Jones. His conversation was most pleasing. His language flowed in an easy, spontaneous manner, and was animated by a vein of sprightly but always unoffending wit, which delighted while it secured attention. He was a *belles-lettres* scholar, was observant, and possessed a good memory; and was ever a most agreeable, entertaining, and instructive companion."

REFERENCES

1. JONES, JOHN. Plain Concise Practical Remarks on the Treatment of Wounds and Fractures; to Which is Added, a Short Appendix on Camp and Military Hospitals; Principally Designed for the Use of young Military Surgeons in North-America, 93 pages. New York, 1775.
2. JONES, JOHN. Plain Concise Practical Remarks, on the Treatment of Wounds and Fractures, To Which is Added, an Appendix on Camp and Military Hospitals; Principally Designed for the Use of young Military and Naval Surgeons in North-America. 2nd ed. 114 pages. Philadelphia, 1776. [Note that while the former edition is designed for the use of young military surgeons, the latter is likewise for young naval surgeons.]
3. MEASE, JAMES. The Surgical Works of the late John Jones, M.D., Formerly Professor of Surgery in the College of New York, Fellow of the American Philosophical Society, President of the Humane Society, and Vice-President of the College of Physicians of Philadelphia, Physician of the Pennsylvania Hospital, and Philadelphia Dispensary. Third Edition. To which are added a Short Account of the Life of the Author, with Occasional Notes and Observations. 3rd ed. Philadelphia, 1795.
4. JONES JOHN. A Case of Anthrax. *Tr. Coll. Phys. Phila.*, 1: 1, 1793.
5. *Gaz. U. S.*, Philadelphia, June 25, 1791.
6. *Penn. Gaz.*, Philadelphia, June 29, 1791.
7. Account of the Life and Character of the late John Jones, M.D., Formerly Professor of Surgery in King's (now Columbia) College, New York &c., *American Medical and Philosophical Register*. New York, 3: 325–337, 1814.
8. THATCHER, JAMES. *American Medical Biography*, Boston, 1828.
9. BECK, JOHN B. An Historical Sketch of the State of American Medicine Before the Revolution. (Annual Address before the Medical Society of the State of New York, February 1, 1842, Albany.)
10. BEEKMAN, JAMES WILLIAM. Centenary Address Delivered Before the Society of the New York Hospital, July 24, 1871.
11. BILLINGS, JOHN SHAW. A Century of American Medicine, 1876.
12. TONER, JOSEPH M. *Tr. A. M. A.*, 29: 689, 1878.
13. RUSCHENBURGER, W. S. W. An Account of the Institution of the College of Physicians of Philadelphia. *Tr. Coll. Phys. Phila.*, 3rd Series, 60: 33, 1887.
14. MITCHELL, S. WEIR. Commemorative Address at the Centennial of the Institution of the College of Physicians of Philadelphia, *ibid.*, 337.
15. HENRY, F. P. Standard History of the Medical Profession of Philadelphia, 1897.
16. SCHROEDER, WILLIAM, SR., *Bklyn. Med. J.*, 15: 473, 1900.
17. HEITMAN, F. B. Historical Register of Officers of the Continental Army, 1775–1783, 2nd ed., p. 324, 1914.
18. SMITH, STEPHEN. History of Surgery. Reference Handbook of the Medical Sciences, 4th ed., 8: 46.
19. BUCK, ALBERT H. Sketch of John Jones, *ibid.*, 5: 705–706.
20. WEAVER, GEORGE H. Dr. John Jones, 1727–1791. *Bull. Soc. Med. Hist. Chicago*, 2: 191–195, 1919.
21. PREBLE, EDWARD. Dictionary of American Biography, 10: 181–182.
22. LOBINGIER, ANDREW STEWART. Master Surgeons of America—John Jones. *Surg., Gynec. & Obst.*, 51: 740–743, 1930.
23. McDANIEL 2d., W. B. John Jones' Introductory Lecture to His Course in Surgery (1769), King's College, Printed from the Author's Manuscript. *Transactions and Studies of the College of Physicians of Philadelphia*, December, 4th series, 8: 180–190, 1940.

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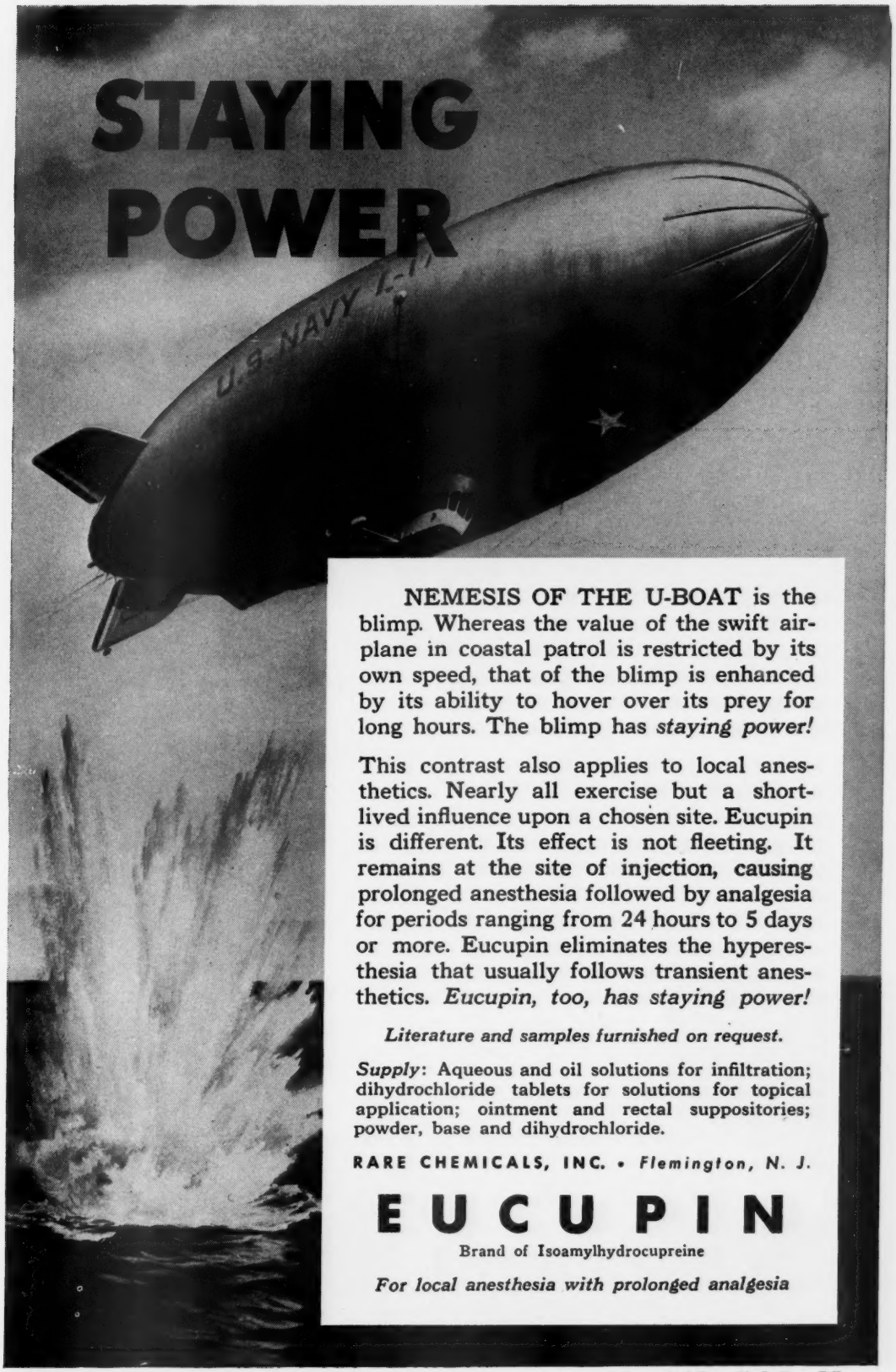

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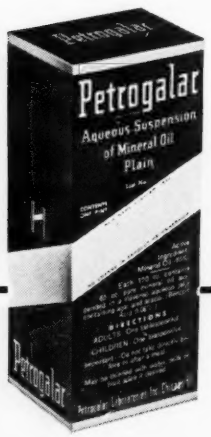

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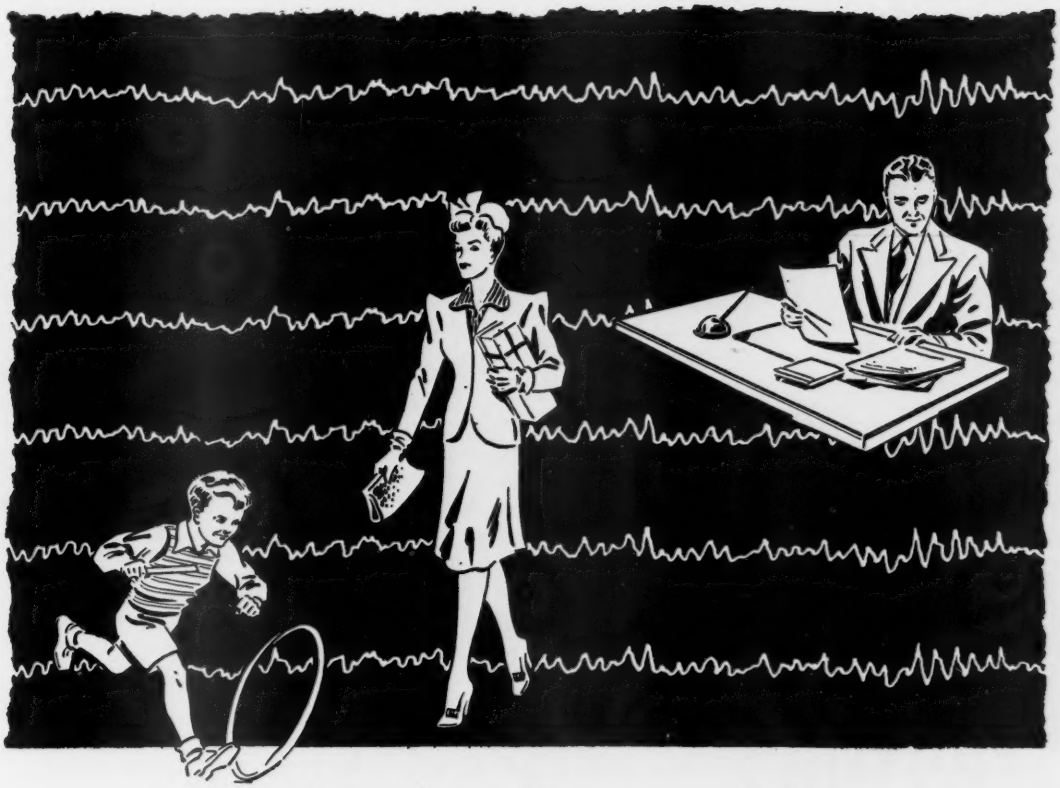

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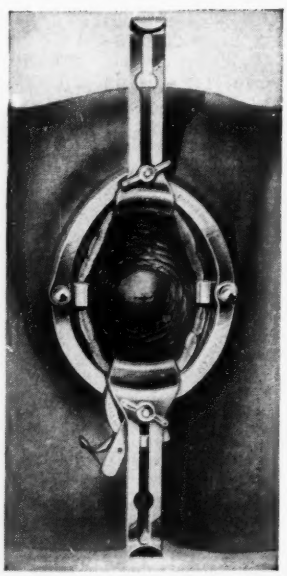

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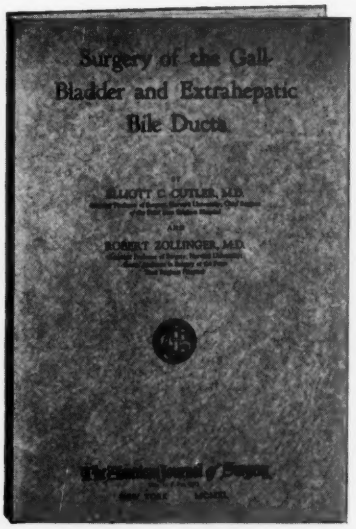

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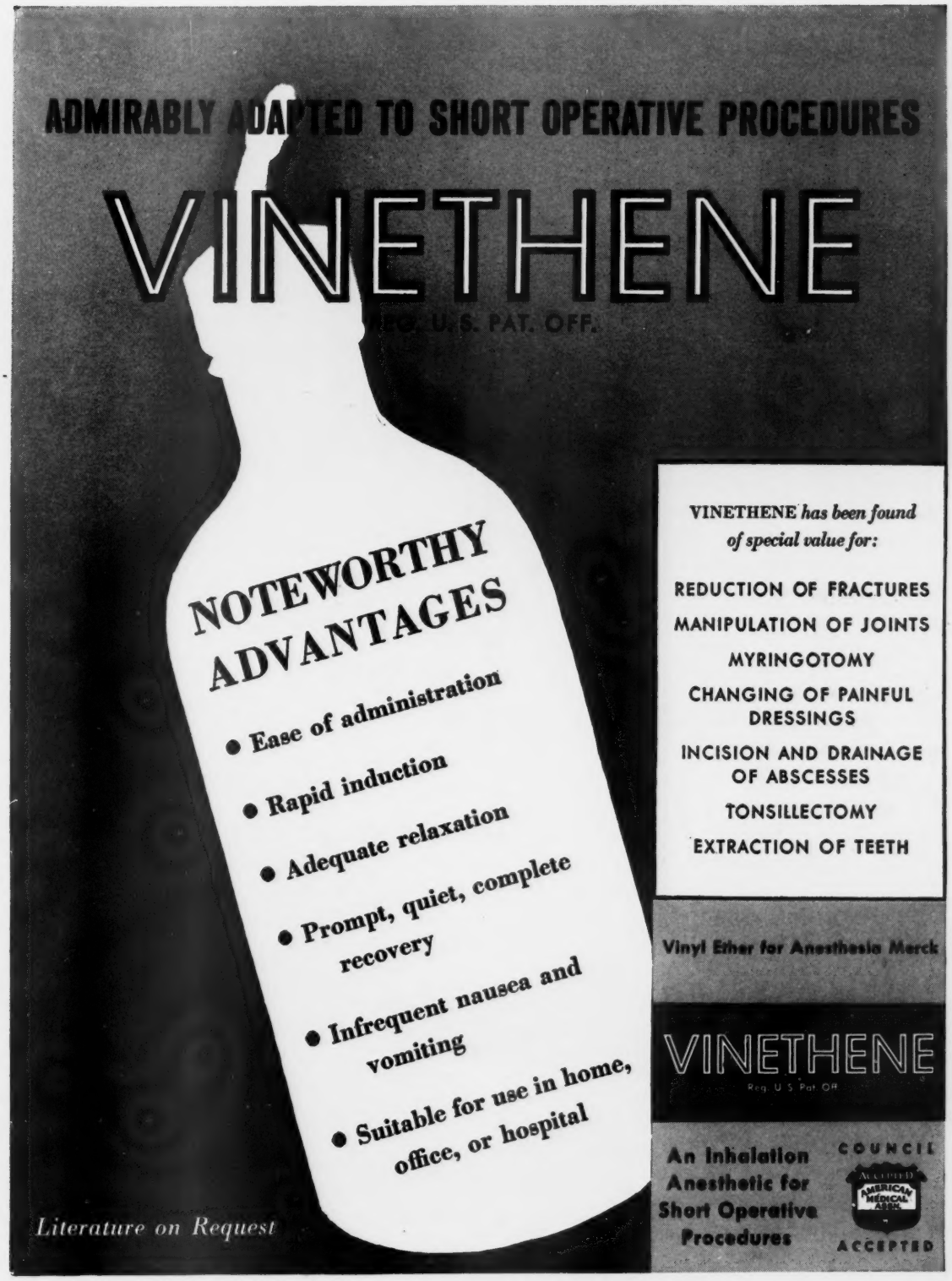

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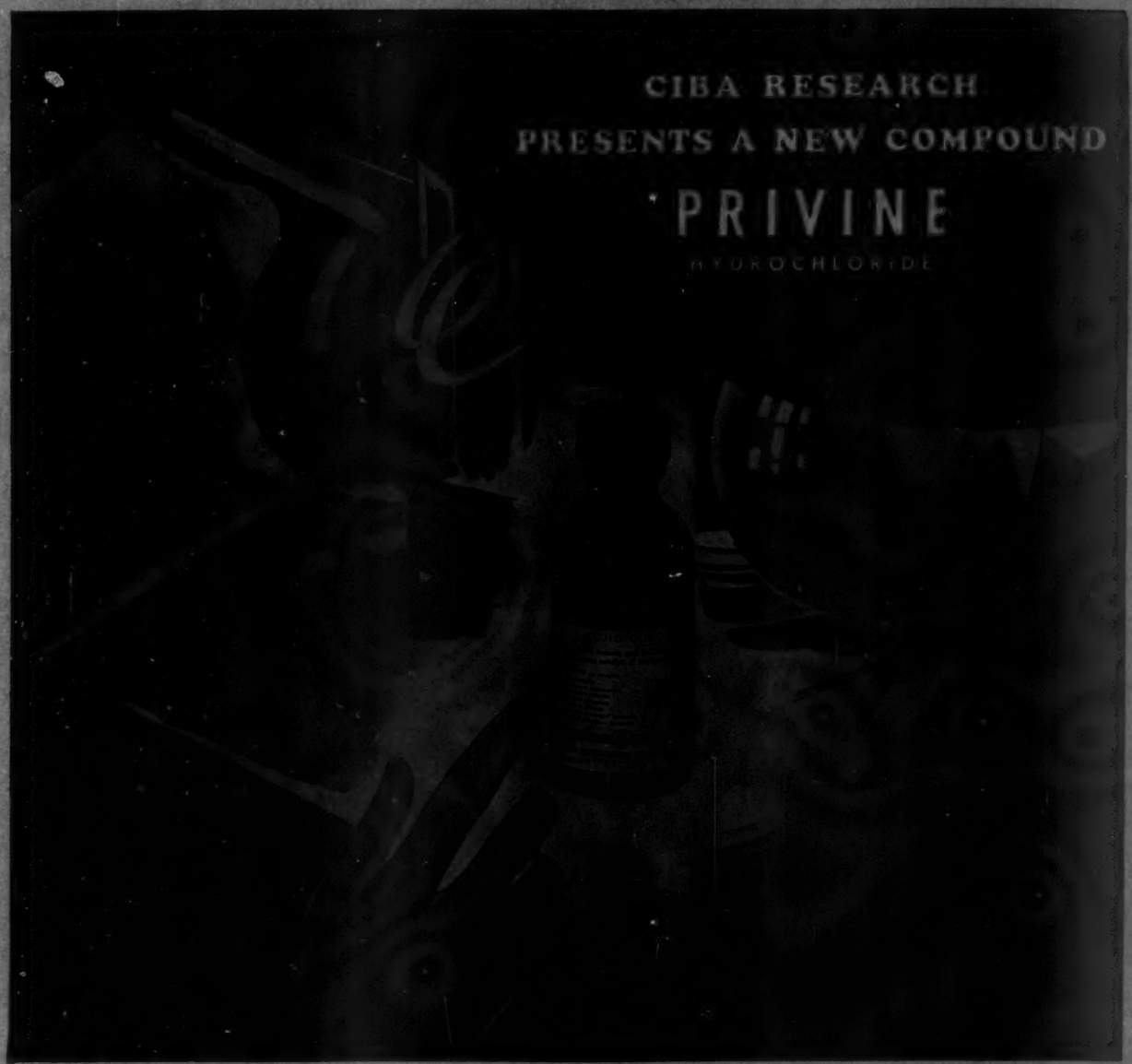

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